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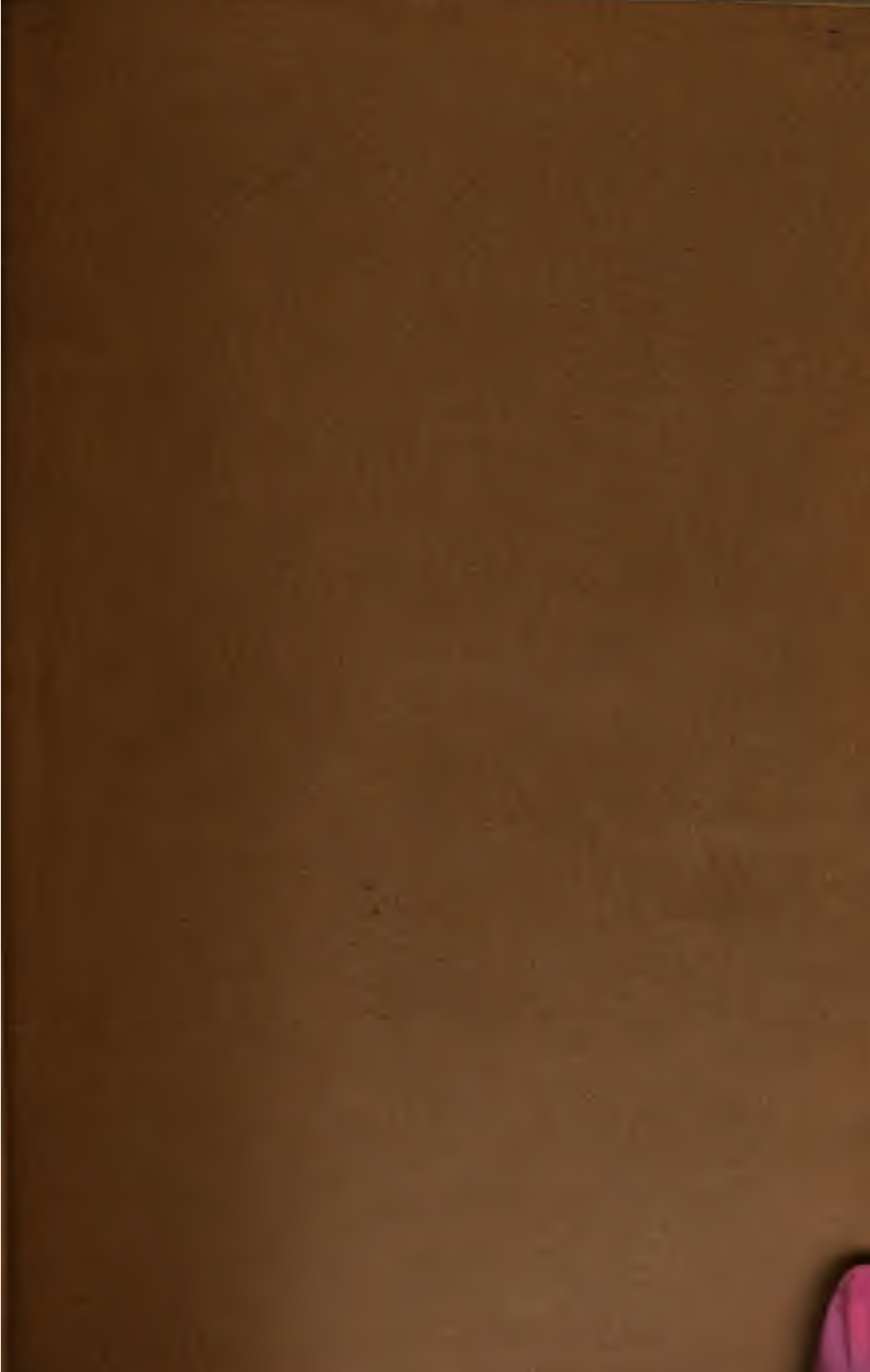
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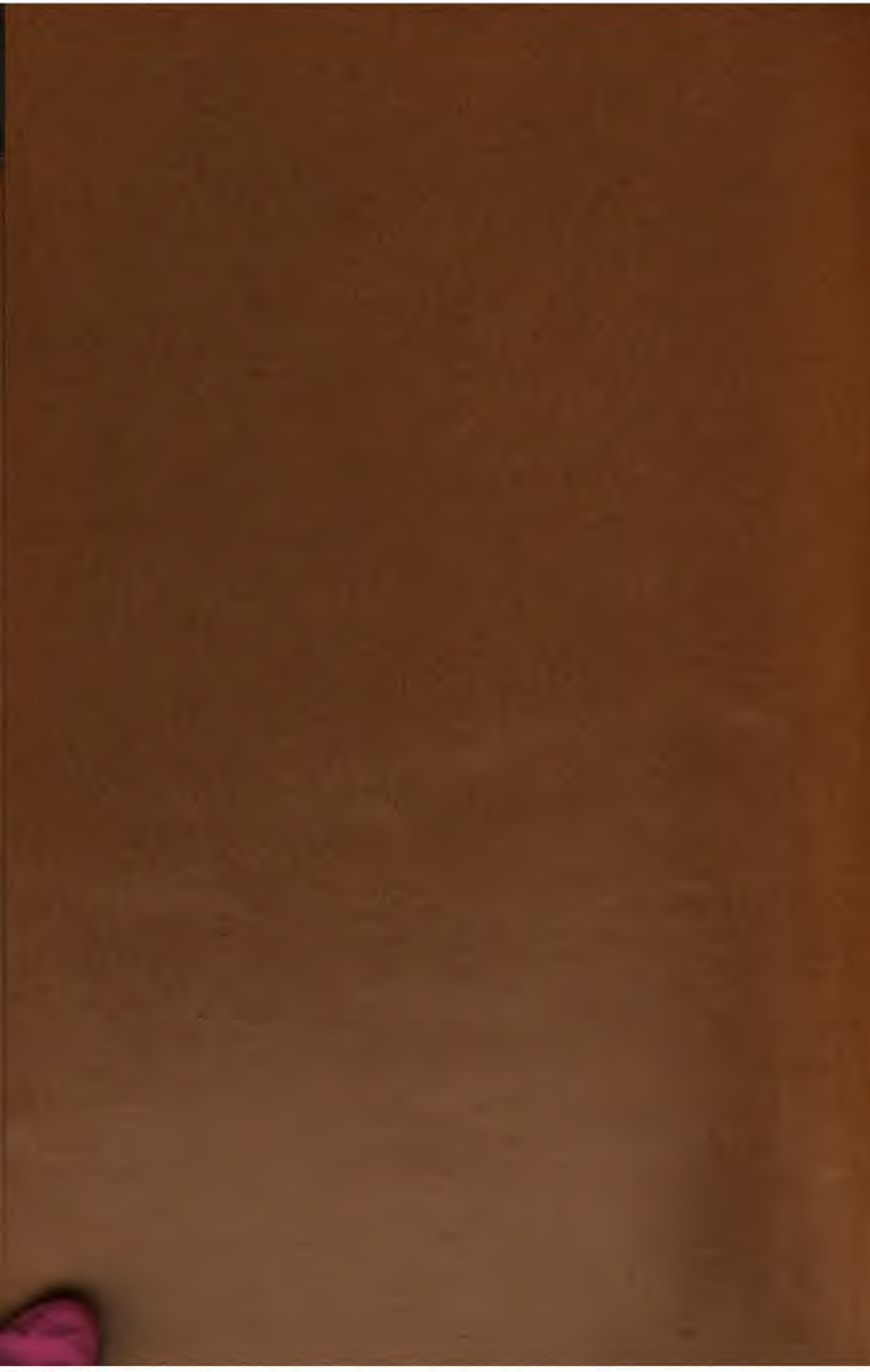
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PROGRESSIVE MEDICINE.

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES,
AND IMPROVEMENTS

IN THE

MEDICAL AND SURGICAL SCIENCES.

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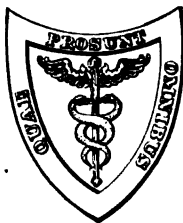
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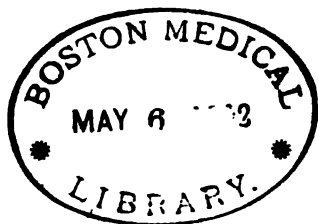
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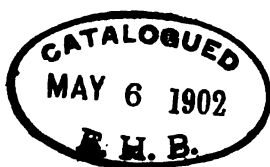
SURGERY OF THE HEAD, NECK, AND CHEST—INFECTIOUS DISEASES,
INCLUDING ACUTE RHEUMATISM, CROUPOUS PNEUMONIA, AND
INFLUENZA—DISEASES OF CHILDREN—PATHOLOGY—
LARYNGOLOGY AND RHINOLOGY—OTOLOGY.



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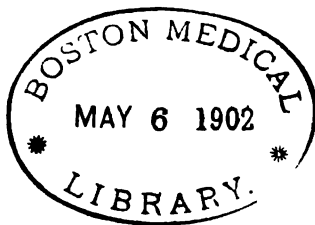
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CONTENTS OF VOLUME I.

SURGERY OF THE HEAD, NECK, AND CHEST	PAGE 17
By CHARLES H. FRAZIER, M.D.	
INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM, CROUPOUS PNEUMONIA, AND INFLUENZA	145
By FRERDERICK A. PACKARD, M.D.	
THE DISEASES OF CHILDREN	221
By FLOYD M. CRANDALL, M.D.	
PATHOLOGY	277
By LUDVIG HEKTOEN, M.D.	
LARYNGOLOGY AND RHINOLOGY	363
By ST. CLAIR THOMSON, M.D., M.R.C.P. (LOND.), F.R.C.S. ENG.	
OTOLOGY	413
By ROBERT L. RANDOLPH, M.D.	
INDEX	449



PROGRESSIVE MEDICINE.

MARCH, 1902.

SURGERY OF THE HEAD, NECK, AND CHEST.

BY CHARLES H. FRAZIER, M.D.

SKULL AND BRAIN.

Malformations. Up to the present time surgeons have failed absolutely in devising an operation which gives the slightest promise of permanent relief in cases of *chronic hydrocephalus*. Hitherto the mortality attending surgical intervention has approached 100 per cent., so that for this reason, if for no other, the conscientious surgeon will strongly advise against the adoption of any radical measures in the treatment of this affection. Until the pathologist furnishes us with more definite information as to the precise nature of the lesion we cannot intelligently deal with the question. Those operations which have been suggested, such as repeated tapplings of the ventricles or the establishment of a permanent communication between the lateral ventricles and subdural space, deal only with the effect rather than the cause.

Collier¹ reported a case in which there was a *deformity of the skull simulating leontiasis ossea*. At the necropsy the lesions of syringomyelia were found, although during life all of the usual signs of that condition were absent. The deformity of the skull, which was thin and associated with meningeal ossification, had been recognizable for fifteen years in a child who, at the age of five years, had fallen a distance of twenty feet, landing upon its head. Skull deformities in syringomyelia are rather rare, and when they are present have features more in common with those of acromegaly. The question arises as to whether syringomyelia might not have been caused by the accident already recorded; it would be difficult to understand, however, how

¹ Lancet, January 5, 1901.

an excessive hemorrhage into the cord could have occurred without making itself manifest through permanent functional disturbances.

Traumatism. After certain injuries to the head, with immediate loss of consciousness, the recovery of consciousness may be followed by a period of unconsciousness. This train of symptoms is the direct result of secondary increase of pressure—the pressure of a clot or of an oedematous brain. Cannon¹ conducted a series of experiments in order to explain the secondary increase of intracranial pressure in head injuries, which is manifested by a recurrence of unconsciousness, deepening into coma, after the patient had passed through a period of consciousness. If one examines the contents of the cranium during operation after traumatic cerebral lesions the dura will feel as though it were under great tension, and the brain will be non-pulsating. Bergmann and others have maintained that this swelling and oedema is due to a passive transudation. It is assumed that there is at first an intracranial hemorrhage, which acts in the capacity of a foreign body and causes obliteration of the veins and capillaries in the region it occupies. In order to overcome this stasis of blood there follows an increase of blood-pressure on the border areas, and this gives rise, in turn, to increased transudation, because plasma may pass more easily into the brain substance than blood through the compressed capillaries. The transudation will increase the volume of the foreign body and compress other capillary areas until the whole brain becomes involved and death ensues. Cannon refutes this theory, on the ground that it does not take into consideration the processes in the brain substance which result from an impaired circulation. He proves by his experiments that swelling and pressure occur wholly independent of any increase of blood-pressure whatever, and that they are the result of a force many times greater than the blood-pressure—one amply sufficient to produce all the pressure symptoms and account for all the clinical signs of intracranial tension. According to Cannon, this secondary increase in intracranial pressure is the result of certain chemical changes in the brain substance itself, which can be accounted for by the interference with the blood-supply. The thromboses, extravasation, and hemorrhages so cut off the blood-supply as to seriously impair the nutrition of the brain substance in the affected area; this disturbance of nutrition causes certain chemical changes in the brain substance which result in an increase in the internal osmotic pressure. When the internal osmotic pressure is increased, as it was proven to be by the use of a normal salt solution, water is taken up by the affected tissues in sufficient quantities to give rise to the oedema and account for the pressure. The

¹ Boston Medical and Surgical Journal, August 8, 1901.

œdema thus produced may cause compression upon neighboring regions and interfere sufficiently with their circulation and nutrition to involve them in the same process, so that eventually an entire hemisphere may be affected. While, therefore, there may be, and often is, an increase of blood-pressure, this does not account for the presence of fluid in the brain substance, for the œdema, for the intracranial pressure; these are due to an increase of the osmotic pressure.

In a paper on "The Immediate and Remote Effects of Brain Injury," read before the Surgical Section of the American Medical Association, in June, 1901, Fairchild¹ places himself on record as in favor of immediate exploration in all cases in which there is the least suspicion of fracture or hemorrhage. In many cases the clinical phenomena are not sufficiently definite to determine the seat or the nature of the lesion, and in these obscure cases additional light will be thrown on the case if, as Fairchild suggests, more attention be paid to the nature of the injury and the mode of its infliction. The character of the accident and the manner in which the force was applied may be of great value in reaching a conclusion as to the nature and seat of the injury. With this idea in view, cases of head injuries may be divided into two classes: 1. Those in which a force of no great intensity has been applied to a limited area of the skull. Such a force may cause a fracture or hemorrhage and but limited injury of the brain tissue itself. These cases, from the nature of the injury and its location, together with the symptoms following, point so carefully to what has transpired in the skull that a careful consideration of all the facts ought to lead to an early operation and an operation for the relief of conditions, as, for example, falling from a height or from a moving train. 2. Those in which, from the nature of the accident, the brain has sustained much more violent injuries. The direct injury to the brain may not have been more serious in its effects than in the first class; but the indirect influence of the fall, the jar to the skull, and the commotion of the cerebro-spinal fluid may produce more or less extensive laceration or contusion of the brain tissue, leading to serious immediate or remote effects.

While in either of these classes the cases may present no alarming symptoms immediately after the injury, and many of them may not present indications for operative intervention, a certain proportion of them subsequently suffer from the remote effects of the injury. According to whether or not relief may be afforded by operation, such cases may be divided into two classes: (1) Those involving pressure lesions manifesting focal symptoms, or irritation lesions, expressing themselves

¹ Journal of the American Medical Association, September 7, 1901.

in Jacksonian epilepsy ; and (2) those involving wide-spread minute lesions, usually scleroses, which affect the nutrition of the organs and are manifested by mental symptoms of a more or less marked degree. In the latter class there is no indication for intervention, and operation can avail nothing ; the lesion is too diffuse ; the alterations in the structure perhaps only microscopical. To the former class belong those cases in which the existing lesion was due to a depressed fracture, to a spicule of bone, to hemorrhage, or a lacerated wound of the brain substance. These are cases in which, had the radical rather than the expectant plan of treatment been employed at the time the injury was inflicted, remote effects would not have occurred. In emphasizing the importance of early operation in the avoidance of these sequelæ Fairchild says : "The second class of head injuries are not uncommon, and are particularly serious in regard to future results because of the fact that they involve wide-spread minute lesions which remotely affect the nutrition of the brain and bring about changes in the delicate mechanisms of the organs. The more diffuse sclerosis of a more widely extended nutritive disturbance is quite beyond the reach of the surgeon, and the sequelæ must be regarded as permanent."

In the discussion that followed the consensus of opinion favored the adoption of a more radical and less expectant line of treatment. In all cases of linear or fissured fracture without any evidence of pressure the skull should be trephined and the region thoroughly explored. Dr. W. H. Earles said that when there is an injury to the skull the case should be treated as though there was also an injury to the brain itself or its membranes, and that the treatment should include careful examination of these structures at the site of the injury. From an analysis of seventy-six cases in his own practice he found an injury to the brain in 87 per cent. Dr. Robert F. Weir makes it a rule to open the cranial cavity in all cases of fissured fracture without waiting for the development of any signs of compression.

Lumbar Puncture as an Aid to Diagnosis in Cases of Head Injury. Tuffier¹ suggests the practice of lumbar puncture as a means of deriving valuable information. The presence of a subarachnoid effusion of blood, as suggestive of fracture, the quantity of the effusion and the extent of the lesions to which such effusion is due, the degree of hemorrhage, as indicated by the intensity of the discoloration, these might all be revealed by this diagnostic measure. Lumbar puncture should not be practised at a very early stage, as the discoloration of the fluid in the lumbar region develops rather slowly. Tuffier suggests the therapeutic value of this operation in relieving pressure upon the

¹ Bull. et Mém. de la Soc. de Chir., No. xxvii., 1901.

nerve centres. If adopted at all this measure would have a very limited field for its application, since it would be of no service whatsoever in the cases in which there was no clue to the seat of the injury.

Fracture of Base of the Skull. Quénu and Tesson¹ describe a variety of basal fracture which they have termed postero-anterior fracture of the base of the skull. The line of fracture begins in the occipital bone, passes across or around the cerebellar fossa to the sphenoid along the petrobasilar suture, and may extend to the ethmoid bone. The fracture must be an unusually rare one, as but three similar cases have been hitherto recorded in the literature. Direct violence is always the cause. The symptoms are those of fracture of the middle or posterior cerebral fossa. In experiments upon the cadaver the authors were successful in producing this lesion in but four of ten attempts.

Brain Tumors. Little or no advance has been made during the past year in the technique of this branch of brain surgery. The immediate success or failure in the attempts at removal of brain tumors depends largely upon the accuracy with which the neurologist is able to locate it and upon its accessibility.

Hoeniger² describes three cases of tumors in the middle portion of the first frontal convolution, and emphasizes the significance of the early development of psychical disturbances in the diagnosis of tumors of the frontal lobe. These manifestations are frequently a loquacity and tendency to joke on all subjects (*hitzelsucht*)—a symptom ascribed by Hoeniger to an irritation of the motor speech-centre in the third left frontal convolution. This symptom is much more frequent when the lesion is situated in the left than in the right hemisphere, and is occasionally associated with facial paresis and a stumbling gait. In Duranti's³ case of a young man with a tumor of the frontal lobe the psychical disturbances, which partook chiefly of an alteration in the moral character, were very marked. The patient died in coma four months after a second attempt to remove the growth. He excised a dural fibrosarcoma located in the post-Rolandic region, from a child aged eighteen months, with gratifying results. The blastomycetes were found in the tumor.

Perkins⁴ presents the pathological report of an angiosarcoma of the right frontal lobe, the examination of which failed to discover any trace of special connection with bloodvessels, either endothelial or epithelial. The diagnosis was made ante-mortem, but owing to the patient's condition operation was deemed unjustifiable.

¹ *Revue de Chirurgie*, No. v., 1901.

² *Münchener med. Wochenschrift*, May 7, 1901.

³ *Gazetta degli Ospitali*, December 2, 1900, p. 16.

⁴ *Cleveland Journal of Medicine*, June, 1901.

The case of spindle-celled sarcoma reported by Clark and Lansdowne¹ is noteworthy because of the absence of any symptoms of localization. An examination revealed loss of vision, severe headache, vertigo, spastic gait, attacks of momentary loss of consciousness, no palsy, but some slight paresis of the external rectus. A zone over the posterior portion of the parietal bone was changed, and upon this evidence the skull was opened and an encapsulated tumor found immediately under the dura. The patient recovered from the operation, but in a few weeks there was evidence of recurrence. The cranial cavity was again opened at the site of the previous operation, and there was found a large tumor bordering on the site of the original growth. After the second operation the patient's general condition rapidly improved, and at the last observation, several months later, continued improvement was noted; the palsies had disappeared, as had the disturbance of speech; there remained only a right-sided hemianopsia and limitation of vision in the lower halves of both retina and a slight disturbance of co-ordination in the region of the right arm. Günzberg² had under observation a child, aged seven years, with a small round-cell sarcoma in the region of the optic. The administration of iodide of potash was followed by temporary improvement, but the child soon after sank into coma and died. Ten such cases are already on record, one having been reported by Virchow, the others by Abelin, Ebstein, Henoch, Russel, Smith, Fretz, Völkel, Joblakoff and Klein, and Graefe.

Inflammations. Meningitis. The treatment of cerebro-spinal meningitis has hitherto been palliative or symptomatic, inasmuch as we have no specific remedy to administer. Measures have been adopted to combat the chills and fever, to alleviate pain, and to promote the absorption and eliminate the poisonous exudate. Many of the symptoms can be traced to the accumulation of the exudate in the subarachnoid space and about the brain and cord, as, for example, persistent headache, somnolence, coma, delirium, convulsions, repeated chills—some due to the mechanical effects of pressure, others to the toxæmia resulting from the absorption of the inflammatory products. With the idea of affording relief by the evacuation of the infectious material, Koplik practised lumbar puncture in a series of five cases which had come under his observation during the past year, with more than gratifying results. Recovery ensued in four of the five cases, the fatal case occurring in an infant but eight months old. In reviewing the effects of the treatment Koplik³ says: "Most of the patients were punctured three times in the course of the disease, and one more frequently. There was no routine

¹ British Medical Journal, April 13, 1901.

² Soc. med. Chir. d'Anvers, December, 1900.

³ Medical News, March 23, 1901.

in the procedure, but each case was studied, and when symptoms of pressure or accumulation of exudate appeared the puncture was made. The indications were continuous headache, accompanied by periods of somnolence and delirium, repeated chills, with a sharp rise of temperature, an increase in the rigidity or opisthotonus, and increasing or continued coma. If the immediate effects of puncture were favorable the procedure was repeated if there was an exacerbation of the symptoms. If continued improvement followed puncture the patient was no longer disturbed. In this conservative way no ill effects of this method of treatment were observed.

"In one patient the effects of puncture were remarkable; the patient upon exacerbation of symptoms requested that the procedure be repeated. The puncture showed that in some cases the fluid was under great tension, and would flow from the canula with a spurt, so that quite a quantity could be withdrawn before the fluid ceased to flow freely. In one case the primary lumbar puncture had no perceptible effect, the somnolence increased, and the second lumbar puncture (15 c.c.) had only a very temporary effect; a dry tap followed. After a few days a fourth puncture, in which 10 c.c. of turbid fluid were withdrawn, was followed by a gradual improvement in symptoms, after which the patient was not disturbed. A second patient was very delirious before the first puncture. After puncture and withdrawal of 50 c.c. of turbid fluid, under great tension, the patient was quieter, slept well, and became more rational; she continued to do moderately well until eleven days after, when she became more noisy, had severe headache and repeated chills. She was cyanosed; was again punctured and 10 c.c. of turbid fluid were withdrawn. Her condition continued unsatisfactory; repeated chills supervened, and she was again punctured and 30 c.c. of turbid fluid under great tension withdrawn. Improvement set in the next day, the headache diminished, and the child could move her head more freely; she still had intervals of noisy delirium and some headache and pain in the back; she slept better at night. Nine days after this, pain in the head reappearing, with occasional noisy intervals and temperature persisting, a puncture was made and 16 c.c. of turbid fluid withdrawn. The patient immediately became brighter and continued to improve. On sudden rise of temperature fifteen days after, with accessions of headache, a tap was again attempted, but nothing was obtained.

"Another case was that of a boy, aged four and a half years, in which at first there was a question as to the possibility of traumatic meningitis. After the first primary puncture of 25 c.c. of turbid fluid, withdrawn under great pressure, the meningococcus being found, the case was diagnosed as cerebro-spinal meningitis of the epidemic type. After

this the boy, who had been stupid and irritable, became more rational, quieter, and said he felt better. His movements, which had been involuntary, were passed voluntarily. Thirty days after admission, the temperature, headache, and rigidity being present, and there being complaint of chilly sensations, 5 c.c. of a turbid fluid were withdrawn. The temperature continued lower, and the symptoms improved gradually until complete recovery. This patient at no time after the first puncture presented anything but the milder type of the disease. He would sit up at times and for days be quite rational. He complained principally of headache and pain in the neck. In another patient the principal symptoms were violent headache and pain in the back of the head and neck. There was delirium at intervals. Lumbar puncture relieved the headache and pain palpably. The infant, aged eight months, was not relieved by lumbar puncture. She was admitted in a comatose condition, and the punctures and withdrawal of fluid did not relieve or clear up any of the symptoms."

As to the effects of lumbar puncture upon the pulse, "It can only be said that the pulse is in some cases temporarily diminished in frequency, in others not at all, and that the respiration continues much the same. This is important, because in those cases of cerebro-spinal meningitis in which just before the fatal issue respiration ceases, whereas the heart continues its action, lumbar puncture will not aid us in restoring the respiratory function. If we look over the results obtained by repeated lumbar puncture we can justly say that they have relieved symptoms. The relief seems to be more in the direction of those symptoms which may fairly be traced to toxæmia and mechanical pressure. At the same time we cannot but feel that the withdrawal of an appreciable amount of any fluid from the spinal canal which contains bacteria and the toxic products of inflammation must be beneficial, in the long run, on the course of the disease. It is premature as yet to say to what extent the prognosis is favorably influenced by this procedure. It is, however, a method which it is certain will come more and more into general vogue and take its place with aspiration of the pleural cavity as a curative method."

The same plan of treatment was carried out by Barth¹ in a case of purulent cerebro-spinal meningitis from a stab wound between the eighth and ninth dorsal vertebra. Seven days after the accident undoubted evidences of meningitis presented themselves, and on the eleventh day the lumbar puncture was practised and a turbid purulent fluid withdrawn containing staphylococci. A laminectomy was performed at the site of the injury and an extradural abscess found, at the bottom of

¹ Beilage zum Centralblatt f. Chirurgie, No. xxix., 1901.

which was a wound in the dura about one-half cm. in length, from which flowed a turbid cerebro-spinal fluid. The wound was somewhat enlarged and packed with iodoform gauze. Immediately after the operation the symptoms abated somewhat, but on the following day the condition again became alarming. Since the operative wound was clean, it was evident that the symptoms were the result of an intradural infection; and after demonstrating by lumbar puncture the presence of pus in the cerebro-spinal fluid a second laminectomy was performed in the region of the second and third lumbar vertebra, the dura opened, and drainage-tubes introduced. The fever rapidly subsided, and with it other evidences of the infectious process, so that on the seventh day the drainage was removed. By these operations the patient's life was undoubtedly saved, although he did not fully recover from the effects of the infection. He has a marked kyphosis at the site of the lumbar laminectomy, slight weakness of the left leg, and some anæsthesia of the posterior surface of the right leg.

CRANIAL NERVES.

Trigeminus. The surgery of the Gasserian ganglion has been successful in surmounting many of the operative difficulties during the past few years, largely through the efforts of those who have made a most careful study of the anatomical relationships of the structures in and about the field of operation. Most of the improvements in the technique may for all practical purposes be grouped under two headings: (1) Those which render the ganglion easier of access, and (2) those which suggest means not of controlling, but of preventing hemorrhage.

THE HISTOLOGICAL STUDY OF THE GASSERIAN GANGLION is a phase of the subject which is attracting the attention of the neuropathologist. Up to the present time Schwab¹ has been able to collect but twenty reports of ganglia which were removed for the relief of trifacial neuralgia. The results of their examination have been various and contradictory. In a certain number of cases the ganglion was reported to be absolutely normal; in another group there was evidence of neuritis and degeneration; in the third—one reported by Spiller and one by Schwab—there was interstitial inflammation; in a fourth, which includes the largest number, there were changes in the nerve cells of various degrees of severity. In order that the reports of the pathological findings be wholly free from any criticism, Schwab suggests the adoption of the following rules: First, a Gasserian ganglion upon the peripheral branches of which surgical operations have previously been made in the

¹ *Annals of Surgery*, June, 1901.

way of nerve-stretching, resection, etc., is unfit for pathological study, or, rather, any conclusions drawn from the findings must be for the most part invalidated, for the reason that the mechanical effects of the operation may cause an ascending neuritis, which might produce changes in the ganglion itself, in the cells, or in the periganglionic tissue. Second, a Gasserian ganglion which is removed by morcellation, or is much torn or cut, cannot be regarded as a favorable object for pathological study. Third, no conclusions in regard to the condition of the nerve cells are justified unless they have been studied by the Nissl method or its various modifications. Of course, the ganglion must be examined in a good state of preservation. Of the two specimens, the reports upon which form the basis of Schwab's paper, one was ideal according to the rules which he has laid down. In both of his specimens the nerve cells were pathologically altered, though not to such a degree as to consider them primarily affected. Neuritis and atrophy were probably present in both; the concentric bodies described by Spiller were found in the second case. From our present knowledge of the pathology it can be positively asserted that there are two separate and distinct types of *tic douloureux*—one in which the lesion is primarily a neuritis of the peripheral branches, which subsequently may or may not extend to and invade the ganglion; the other, in which the primary lesion, an interstitial inflammation, first appears in the ganglion. To these two types may be added a third, of which the essential and primary lesion is a neuritis of the sensory root. Were the clinician able to recognize in his cases symptoms which would justify a classification corresponding to that of the neuropathologist, the indications for treatment would be more clearly defined. If the lesion was a peripheral neuritis, resection of the nerve trunk would be clearly indicated—a central operation would be unjustifiable; if, on the other hand, the lesion was primarily centrally situated in either ganglion or sensory root, the futility of the peripheral operation would be apparent.

ANATOMY OF THE GASSERIAN GANGLION. From the surgeon's stand-point, familiarity with the topographical anatomy is an absolute essential. The greater his knowledge of the structures concerned in the field of operation the more dexterous and rapid will be the operation and the fewer the complications. The topographical anatomy of the middle meningeal artery, the attachments of the dura, the bony anatomy of the base of the skull, the relative position of the foramina ovale and rotundum as surgical landmarks, the intimate relationship of the structures of the cavernous sinus together with the third, fourth, and sixth nerves to the internal aspect of the ganglion, the source from which the ganglia receive their blood-supply, are some of the points with which the surgeon must be familiar. He must be

familiar not only with the normal, but with the more common variations and anomalies, of which there are not a few. Amyx¹ in his observation of something over fifty skulls noted a relation between the shape of the skull and the development of the bony processes on its base: "Thus in skulls having a great transverse width just in front of the ears—a width consisting of the skull alone, without any additional muscles or the zygomatic arch—the floor of the middle fossa does not have any marked bony prominences arising from it; while in heads not having a great transverse diameter between the ears, but whose external bony prominences are large and sharply marked, the floor of the middle fossa is studded with large, bony prominences, which are situated externally to the foramen ovale and rotundum. We often encounter skulls having a combination of these two types. A knowledge of the above facts will give us some kind of information of the condition that we are to meet with in the middle fossa. The wider head gives a smooth floor to work over in order to dissect the ganglion; but it has the disadvantage of a greater distance to the site of the ganglion—a condition which usually lessens the amount of light that can be thrown into the aperture. On the other hand, the narrow head offers a shorter distance to the ganglion, but usually has the disadvantage of having large bony prominences which obstruct the view to the foramen ovale and sometimes to the foramen rotundum, so that the removal of the ganglion is laborious and oftentimes impossible until the prominences of bone are removed from the floor of the middle fossa." The wider the skull the greater will be the distance to the ganglion and the larger must be the opening made in the skull in order to allow an elevation of the brain sufficient to properly expose the ganglion. The distance to the ganglion can be shortened materially by opening forward toward the foramen rotundum. It may be necessary in some instances to chisel the bony prominences from the floor of the middle fossa, in which case the chiselling should be from behind forward, in order to avoid injuring the middle meningeal artery. In his observations Amyx found a great variation in the course and distribution of the middle meningeal artery. In some instances it lay between the foramen rotundum and foramen ovale, near the foramen lacerum medium; in others it was not present at all; rarely it was found lying internally to the foramen rotundum, its course after passing immediately over the foramen rotundum being upward to the overhanging border of the lesser wing of the sphenoid, from which point it passes along to the outer extremity of the lesser wing, and thence over to the parietal bone. In this position the artery offers the greatest obstacle to the complete

¹ Medical Record, July 6, 1901.

removal, on account of its close proximity to the inner border of the ganglion. As to the nerves within the cavernous sinus, particular attention is called to the intimate relation of the sixth nerve with the ophthalmic division of the fifth as it passes through the sphenoidal fissure. They are so intimately connected that any undue violence exerted on one is almost sure to injure the other.

Dollinger,¹ from an examination of a large number of skulls, observed that in about 60 per cent. the middle meningeal artery lies so far behind the foramen ovale that one can approach it without requiring ligature and subsequent division of that vessel; and he concludes that in about 96 per cent. of cases one ought to be able to remove the Gasserian ganglion without injuring the vessel.

THE INDICATIONS FOR OPERATIVE INTERVENTION are no more closely defined to-day than a year ago, but not until we can distinguish clinically between those cases in which the symptoms are due to a peripheral lesion and those in which they are due to a central lesion can any definite rules be laid down. White,² in discussing the treatment, divides cases of tic douloureux into three periods: (1) The period of medical treatment; (2) the period of peripheral operation, and (3) the period of intracranial operation. As to the first—excluding those cases of a migrainous type, which occur chiefly in women approaching the menopause, who should be regarded as subjects for medical rather than surgical treatment—medical measures should be employed for from six months to a year, the time varying in inverse proportion to the severity of the attacks and in direct proportion to the length of the remissions. Strychnine in heroic doses given hypodermically has yielded the best results. Beginning with one-thirtieth of a grain hypodermically once a day, the dose is gradually increased every third day until at the end of the second week of treatment the maximum dose—one-tenth of a grain—has been reached. When internal remedies have failed to afford relief temporary or permanent, and when the pain is confined to the distribution of one or two branches of the ganglion, the period for the peripheral operation has been reached. When we have records of cases remaining free from recurrence for periods varying from two to twelve years no other argument in favor of the peripheral method need be advanced. Even with the knowledge that permanent cure is rare, and that a remission, long or short, is at the best all that can be hoped for, both surgeons and patients will continue to prefer the milder operation. Finally, the intracranial operation as a primary procedure, White says, is to be reserved for exceptional cases in which,

¹ Medical Press and Circular (London), December 19, 1900.

² University of Pennsylvania Medical Bulletin, June, 1901.

from the beginning, there has been an excessively wide distribution of pain, and in which the pain is of great severity, and as a secondary procedure for cases in which the internal medication or extracranial operations have failed to afford relief.

METHOD OF REMOVING THE GASSERIAN GANGLION. No radical changes have been made in the technique for the excision of the ganglion. The pterygoid route of Rose and the temporosphenoidal route of Doyen have been practically abandoned in favor of the temporal route, first advocated by Hartley and Krause and recently modified by Cushing. Sapejko¹ goes so far as to recommend the removal of the greater wing of the sphenoid up to and including the foramina ovale and rotundum, claiming that the Krause method does not give sufficient access to the field, and that the necessary retraction of the brain during the long and tedious operative manœuvres subjects the brain to serious pressure. The first step in his operation is the application of a provisional ligature to the external carotid (this preliminary procedure was suggested by G. G. Davis some two years ago, but has not been generally adopted). After deflecting the temporal flap and resecting the zygoma the great wing of the sphenoid is cut down to the foramina. During the remainder of the operation the brain is held out of the way by an automatic spring retractor, which is screwed to the skull above; the lower portion of the retractor is constructed to reflect light upon the field of operation. After isolating the ganglion he concludes the operation by resecting as much of each branch as possible, beginning with the first. The second branch is resected up to its entrance into the infra-orbital canal, and the third branch is pushed through its foramen and out through the small incision which was made for applying the provisional ligature to the external carotid. At the conclusion of the operation drainage is introduced through the wound over the carotid. There is no question but that Sapejko's operation affords a better exposure of the ganglion, nor is there any question that its adoption would increase the mortality. The wholesale temporosphenoidal resection of the skull is altogether unnecessary, and therefore unjustifiable. So, too, the resection of the branches to such a distance from the ganglion should be regarded as altogether unnecessary, providing the operator has been successful in removing the ganglion intact. Chipault,² who asserts that what he calls the complete peripheral operation—that is, the resection of the nerve back to its point of exit from the skull—gives almost as good results as resection of the ganglion, plugs the foramen ovale and rotundum with gold, in order to prevent regeneration of

¹ *Revue de Chirurgie*, September, 1901.

² *Indépendance Médicale*, No. xxv., 1901.

the nerve. In four of the series of twenty-eight cases he practised resection of the cervical sympathetic, with only temporary improvement. Krause, whose experience includes as many as twenty-seven intracranial operations, recommends the ligation of the middle meningeal vessels as a routine measure. This step prolongs the operation but a few moments, and eliminates at least one of the sources of troublesome hemorrhage. If the central ligature should slip he introduces into the foramen spinosum a short, rectangular hook, which is allowed to remain until hemorrhage has ceased or until the operation is concluded. If then the bleeding from the middle meningeal persists he plugs the foramen with a small piece of gauze. Several rectangular hooks of various sizes are kept on hand for this emergency. One hesitates to criticise the views and opinions of such a man as Krause, who in his series of twenty-seven cases has probably had more opportunities for personal observation than any other surgeon. The natural inclination would be to accept without hesitation the technique which Krause¹ has finally adopted, and yet his dictum—that the middle meningeal should be ligated as a routine step—would seem open to question. In the first place, the application of a ligature to the vessel is in itself a tedious and ticklish procedure, and would, with an operator of limited practice in this field, require some little time; secondly, experience has taught us that by the infra-arterial route the operation can, in the majority of cases, be completed without lacerating the vessel; in the small minority hemorrhage from the vessel can be controlled either by packing or, as Krause suggests, plugging the foramen. In a paper read before the Thirtieth Congress of the Deutsche Gesellschaft für Chirurgie, Krause summed up the results based upon his 27 intracranial resections of the trigeminus, of which 25 were typical extirpations of the ganglia. In only 16 cases was it necessary to perform the operation in two steps. The duration of the operation depended upon the degree of hemorrhage and the time necessary to control it. The average time consumed in each operation was one hour and a half. When the hemorrhage was moderate the operation took, on an average, from fifty to fifty-five minutes; in the last 3 cases of the series the operation was completed in twenty-five minutes.

IMMEDIATE OPERATIVE RESULTS. Of the 27 operations 3 terminated fatally—a mortality of 11 per cent. Of these 3, 1 died within a few hours, in collapse; 1 in six days, of heart failure; and 1 on the twentieth day, cause unknown. In every case the wound ran an aseptic course, so that none were complicated by the subsequent development of cerebral abscesses, which have been met with in the experi-

¹ Beilage zum Centralblatt f. Chirurgie, No. xxix., 1901.

ence of others. Considering the fact that his series includes the period before so many valuable contributions had been made to the technique of the surgery of the trigeminus, the low mortality which Krause attained is both creditable and encouraging. It would be interesting to know the results of those operations performed recently, in order to compare them with the results of his more modern efforts. The mortality in 101 cases collected by Tiffany in 1896 was 22.2 per cent. In the series of 100 cases collected by Carson from 1896 to 1899 the mortality was 11 per cent., which corresponds to Krause's rate of mortality for his entire series. There is every reason to believe that in experienced hands the mortality during the past year has been lowered still further.

AMONG THE CEREBRAL COMPLICATIONS noted by Krause were temporary somnolence, cephalalgia, restlessness, vertigo, and in two instances a temporary aphasia. The danger of ulceration of the cornea is greatest during the first week, after which time the eyes require no protection. In one instance a corneal ulcer developed two years after the operation, but it responded promptly to treatment. The most interesting, from every point of view, are the permanent results. Krause has yet to see his first case of recurrence; in five cases six to eight years, and in eleven cases two years, have elapsed without recurrence.

Division of the Sensory Root of the Trigeminus for Tic Douloureux. The most recent contribution to the surgery of the trigeminus is that of Spiller and Frazier,¹ who recommend division of the sensory root of the trigeminus for the relief of tic douloureux as a substitute for all operations which attack the ganglion itself. The plan of operation so radically different was suggested by Spiller in 1899, but Frazier withheld his indorsement until convinced that regeneration of the nerve fibres at the point of division was doubtful, and that in view of this uncertainty, therefore, this operation might be justified. In order to demonstrate experimentally that regeneration would not take place, Frazier conducted with Spiller a series of experiments in which the proposed operation was practised upon dogs. Upon the acceptance of the interpretation of the results of these experiments will depend the indorsement of the operation under discussion. Spiller has gone so carefully into the subject of regeneration of the sensory roots of the central nervous system that in view of its importance to the topic under discussion we feel it incumbent upon us to quote freely from his paper. After a very important review of the literature and the results of his own experiments upon dogs, Spiller thinks we must conclude that further study is necessary before we can be convinced

¹ University of Pennsylvania Medical Bulletin, December, 1901.

that regeneration of sensory nerve roots in man occurs, and that full restoration of function is possible after division of sensory nerve roots. Even if a partial regeneration of these roots were possible it does not follow that pain would return after division of the sensory root of the trigeminal nerve. There might be a partial return of sensation without pain. We must acknowledge that some evidence of partial return of function in injured posterior roots in animals exists, but no evidence of return of function in the trigeminus after the division of its sensory root is to be found in the literature. It is a question whether the fibres of this root could penetrate through the thick bands of the middle cerebellar peduncle and pyramidal tract to the sensory trigeminal nucleus of the nerve within the pons.

In view of the uncertainty of regeneration of the sensory root of the trigeminal nerve, and of the great mortality in removal of the Gasserian ganglion, the division of the sensory root for the relief of *tic douloureux* is a justifiable procedure, and I trust we may be able to keep under observation for at least two or three years the patient on whom Frazier has performed this operation. We are not urging that division of the sensory root should at once replace removal of the Gasserian ganglion, and distinctly recognize that the former operation is on trial.

Frazier has shown by experimentation that the motor root of the trigeminus in the dog may be spared. The possibility of saving this root was present in my mind when I urged that this operation should be tried. The motor root has never been left intact when the Gasserian ganglion has been entirely removed, and it probably never can be. It seems to me a fortunate occurrence that in this first successful operation on the sensory root of the trigeminus Frazier divided the motor root as well as the sensory. All communication between the Gasserian ganglion and the pons was in this way fully destroyed, and the best possible conditions were obtained for testing the possibility of regeneration of the sensory root. If this case should be as successful clinically as it has been surgically we may be able hereafter to relieve the pain of *tic douloureux* without paralyzing the muscles of mastication, for Frazier's operation seems to indicate that he is able to save the motor root; and we may also be able to lessen the danger of loss of vision, inasmuch as by division of the sensory root the nerve cell-bodies of the Gasserian ganglion are left in normal relation with the peripheral distribution of the trigeminus, and changes in the cornea may be less likely to occur. It is not improbable that these cell-bodies exert a trophic influence on the peripheral branches of this nerve. If this operation should be done again it would be well to resect the sensory and motor roots instead of merely dividing them. If it shall be fully

established that the sensory root will not regenerate after it is cut, the motor root should be spared.

METHOD OF OPERATING. The following are the steps of the operation as described by Frazier: 1. Reflection of a horseshoe-shaped flap of skin and subcutaneous tissue. The flap corresponds in width to the length of the zygoma; its base is on a level with the lower border of the zygoma, its convexity reaching a point 6 cm. above. 2. Division of the zygomatic processes of the malar and temporal bones. After reflection of the superficial flap of skin and subcutaneous tissue an incision is made in the periosteum over the middle of the zygoma throughout its length, and the periosteum elevated sufficiently to allow of the introduction of the bone-cutting forceps and the division of the zygomatic processes of the malar and temporal bone. In operations upon dogs, where the field of operation was so much smaller than that of the human subject, and where the bellies of the temporal and masseter muscles were proportionally so much larger, I found it absolutely necessary to resect the zygoma in order to be able to retract the temporal muscle sufficiently to allow of a proper exposure of the field of operation, and I determined to introduce this step into the technique of my next operation upon the human subject. It is better to practice a temporary rather than a permanent resection of the zygoma. At first thought one might think it inadvisable to replace the segment, on the ground that the bone might not become united owing to the difficulty of keeping it at rest. One would realize how unlikely it is that this will occur if one takes into consideration that the most likely cause of displacement—muscular action—is not operative, because the muscles attached to the fragment of bone and concerned in the act of mastication will have been deprived of their motor nervous supply, which is derived from the inframaxillary branch of the trigeminus, before the operation has been completed. (This assertion is based upon the assumption that the integrity of the motor root of the ganglion has in but very few instances been preserved.) One or two sutures introduced at either end of the fragment through the periosteum will suffice to ensure fixation until union occurs. Necrosis of this fragment has been recorded as a possible unfavorable complication of temporary resection, but this can be avoided if one bears in mind that the bone receives a liberal blood-supply through the periosteum and avoids stripping this structure from the bone except at the points where the bone-cutting forceps have to be applied. 3. Reflection of a horseshoe-shaped flap, composed of temporal fascia, muscle, zygoma, and pericranium, corresponding in shape to the superficial one, but of somewhat smaller dimensions. This flap is reflected sufficiently to expose to view the temporal fossa; during the operation it will be subjected to considerable

traumatism consequent to the constant traction and pressure, and will be swollen and tender for a short time. Owing to the contractile character of the tissue of which it is composed the flap will shrink at least one-third before the operation is completed, so that some little traction will have to be made in order to approximate the edges upon closure of the wound. 4. Removal with the trephine of a button of bone at a point corresponding to the middle of area exposed, and enlargement of the opening with the rongeur forceps until its diameter measures three to four centimetres. The usual precaution must be taken in trephining here, as in any portion of the calvarium where the bone is of such variable thickness, in order to avoid injuring the dura; and additional precautions are necessary in this region, owing to the fact that the middle meningeal artery lies immediately beneath the button of bone to be removed. With the rongeur forceps the trephine opening is enlarged about equally in all directions, and should extend downward to the level of the crista infratemporalis. 5. Separation of the dura and exposure of the ganglion and its sensory root. The adherent dura is separated by blunt dissection (the handle of a scalpel enveloped in a single layer of gauze will meet all indications) inward and forward until the foramen ovale or rotundum comes into view, either of which serves as a guide to the site of the ganglion. This is the most tedious stage of the operation, and one which taxes the patience of the operator to the utmost. Hemorrhage now constitutes the great bugbear. Protracted and persistent oozing follows the separation of the dura from every point at which it is adherent to the skull; the older the patient the firmer the adhesion and the freer the hemorrhage. Hæmostasis can be effected only by pressure and heat; small pledgets of gauze saturated with a hot saline solution are cautiously applied to the bleeding-point and allowed to remain for periods of from two to five minutes. In my series of operations upon dogs I tested the efficiency of gelatin in 5 per cent. solution as a hæmostat in intracranial operations, with practically negative results. The solution had no apparent effect. The dura is most adherent to the skull at the margins of the foramina, so that the most troublesome bleeding is not experienced until one has arrived almost at the site of the ganglion. Second only to hemorrhage as a troublesome feature of this stage of the operation is the presence of large bony eminences on the floor of the middle fossa. As pointed out by Amyx, these eminences are more commonly met with in heads not having a great transverse diameter between the ears, but whose external bony prominences are well marked, rather than in those skulls with a large transverse width; these prominences are situated usually external to the foramina ovale and rotundum, and if very large will have to be chiselled off, in order to expose the foramina to view and

remove the ganglion. In some cases the ganglion itself lies beneath a bony roof, as though it were a continuation of the petrous portion of the temporal bone. While this is an anomaly in men it is not so in the dog. Almost without exception in the series of dogs' skulls which I had an opportunity to examine while carrying on the experimental work the ganglion was covered by a thin shell of bone, which had to be removed in order to bring to view the ganglion and its sensory root. With hemorrhage well enough under control to enable one to recognize the anatomical landmarks, the operator makes an incision into the dura and dura propria, between the foramen ovale and spinosum, and with a blunt dissector separates the dural envelope from the upper surface of the ganglion as far back as may be necessary to expose to view the sensory root. 6. Up to this point the method of procedure has not differed essentially from those operations which have in view the extirpation of the ganglion. From now on the courses diverge: In the one the operator proceeds to liberate and extract the ganglion and its branches; in the other, to liberate and divide the sensory root.

The division of the root is not a difficult performance. When fully exposed it is picked up on a blunt hook, which is passed around the nerve from without inward. The nerve is divided either by making traction with the hook or cutting directly upon the hook with knife or scissors. It would be a better plan, however—and I will carry it out in future cases—after elevation of the nerve upon the hook to grasp it with a pair of forceps, hæmostatic or dissecting, and remove a small section with knife or scissors. This slight modification will add nothing to the dangers and little to the difficulties of the operation, and will serve a twofold purpose: on the one hand furnishing a specimen for a pathological examination, and on the other leaving a defect in the continuity of the nerve which would render regeneration a possibility still more remote.

In connection with this step of the operation there is one point which will naturally come up for discussion. Can the sensory root be isolated from the motor root so that the integrity of the latter may be preserved? This question may be answered in the affirmative if certain reservations be made. That it is possible upon the living subject to separate the motor from the sensory root was proved by my own case, as I had practically concluded the operation and was about to close the wound. In order to assure myself that none of the fibres of the sensory root had been left undivided, I repeated the last step of the operation, and in so doing picked up the motor root, which up to this time had remained intact, and unintentionally divided it. It is possible, therefore, to divide the sensory without the motor root. Whether we can

attain sufficient dexterity to avoid the accident which happened in my case is a matter to be settled by future repeated observations.

Whether or not the operation has a future will depend upon the acceptance of the facts embodied in the following two assertions: 1. Regeneration of the sensory root will not take place after its division. 2. (a) Liberation and division of the sensory root, obviating many of the operative difficulties associated with the liberation and extraction of the ganglion, is easier of execution; (b) the integrity of the structures of the cavernous sinus is not endangered; (c) the operation should be attended with a lower mortality. Frazier then goes on to substantiate the claims which have been advanced from the surgical aspect. Granting hemorrhage to be the greatest danger, and acknowledging the act of separating the base of the ganglion from the base of the skull as the cause of the freest and most troublesome hemorrhage, one can justly claim for the operation, leaving the ganglion undisturbed, a distinct advantage. Furthermore, the time required to separate the ganglion from its base, and the additional time required to control or check the flow of blood before the operation can be proceeded with, must be taken into consideration and given due weight in the estimation of the relative merits of the operations under discussion.

Should any injury happen the cavernous sinus, bleeding may be so profuse as to give cause for alarm. The sinus is exposed to danger once the operator begins to free the internal aspect of the ganglion, and in this connection Cushing says "that it is well to conduct these manipulations as near as possible to the sensory root, since that is the safest point and one at which there is less likelihood of injuring the cavernous sinus and sixth nerve." Therefore, in limiting our field of operation to the posterior aspect of the ganglion and its sensory root we confine our manipulations to the point of greatest safety. Too much stress should not be laid upon the superiority of one operation which is associated with less bleeding than another, as the amount of blood lost in either is not a menace to life and will not very materially affect the ultimate results. The control of hemorrhage necessary to the continuance of the operative manœuvres, however, is effected only after the repeated application of pressure for various periods of time, which in the aggregate may rightly be considered as a factor unfavorably influencing the results.

It is claimed that certain operative difficulties and dangers are avoided. It goes without saying that the exposure of the ganglion is by far less difficult than its extraction. The ganglion and its three divisions are so firmly bound down to the base of the skull that the liberation of the structures is the step of the operation which, above all

others, tests the skill, dexterity, and patience of the operator. For the completion of this step of the operation one begins by exposing the superior surface (to quote Cushing again) "of the stellate structures well back onto the sensory root." Without going further, without exciting one whit more hemorrhage, without running any further risk of injuring adjacent structures, all the preparations necessary for division of the sensory root have been made. Thus one operation is practically complete before those difficulties common to the other operations have been encountered.

Not only is the integrity of the cavernous sinus itself preserved, but all those structures in close association with it, particularly the sixth nerve, which is in such proximity to the ophthalmic division of the ganglion that it is almost always injured during the extraction of the ganglion. Needless to say that in the division of the sensory root there is not the slightest excuse for interfering in any way with the sixth nerve. It is further claimed that there are some grounds for believing that trophic disturbances in the cornea secondary to division of the first root or the ganglion itself may not follow the division of the sensory root because of the probable presence in the ganglion of trophic centres presiding over the peripheral nerve. In the case which is reported by the authors there was not a suspicion of a keratitis, although a very simple dressing, consisting of a compress saturated with boric acid, was applied to the eye, and this for only one week following the operation.

Frazier has performed the operation but once upon the human subject, and with gratifying results. The patient was discharged from the hospital twenty-one days after the operation, having had since the operation complete anæsthesia over the area corresponding to the distribution of the trigeminus. During the post-operative period nothing worthy of note occurred. The permanency of the relief, the persistency of the anæsthesia as indicative of the absence of any attempt at regeneration of the root, can alone prove the operation is at least justifiable. Until sufficient time has elapsed to prove in practice what has been advanced upon experimental and theoretical grounds it is not probable that the newly recommended operation will take the place of the well-established one.

EPILEPSY.

From the surgeon's point of view epilepsy is still his *bête noir*. In none but the Jacksonian type has he the slightest provocation for even suggesting surgical measures, and even in this limited field the results are anything but promising. The absence of any well-defined morbid lesion in the brain, the absence even in traumatic cases, as it often happens,

of any demonstrable source of irritation, the almost hopeless outlook once the epileptic state is well established are obstacles with which one is confronted once he tries to grapple with the subject. Without any definite knowledge of the pathogenesis of epilepsy, any suggestions as to treatment must be of a purely empirical nature. The extirpation of the epileptic centre in the cortex in the Jacksonian type has met with a measure of success. The failures have been accounted for in various ways. By some they have been attributed to the formation of adhesions between the brain meninges and calvarium; by others on the ground that the remaining parts of the cortex assume, to a certain extent, the function of the part extirpated, and that the results of the operative procedure are necessarily transitory (Raymond). Fraenkel¹ and others attribute failures to the development of secondary epileptic centres, and Putnam regards the establishment of the "epileptic state" as responsible for the failures in treatment. Raymond, for the purpose of considering the results of extirpation of the epileptic centre in traumatic Jacksonian epilepsy, divides the cases into two groups: (1) Those in which the area to be removed was determined by faradic stimulation; and (2) those in which the guide to the epileptic centre was merely anatomical topography. In five cases of the first group the results were absolutely negative; in five others there was only a temporary cessation of the convulsions, and in five the effect of the operation was permanent. Not only was there a cessation of the convulsions for a period of five years (the period designated by Horsley as the minimum time which must elapse before the case can be regarded as cured), but the paralysis resulting from the removal of the motor area had passed away. In the second group, which comprised sixteen cases, four were unimproved, six improved, and six were relieved of convulsions for various periods up to four years. To express in figures the results obtained from the thirty-one cases of both groups, it can be said that 30 per cent. were unimproved, 35 per cent. improved or ameliorated for various periods, and 35 per cent., now under observation for periods varying from one to five years, have been absolutely free from convulsions. These are results which must be given very thoughtful consideration; and even though the percentage of absolute cures be small and the period of observation limited, in some this operative procedure would seem to give promise of a brighter future than any hitherto tested. There is no question but that the percentage of recoveries or cures in this series is very much higher than we would be justified in anticipating after the adoption of this operation. In considering the results of any operative procedure in traumatic epilepsy

¹ Archives de Neurologie, 1901, vol. xl. p. 369.

one must take into account the effects of operation *per se* which were pointed out by White in 1891. This observer published a series of tables containing 172 cases of epilepsy, 147 of which had been subjected to a great variety of operations, and of these 147, 124 were apparently so much benefited that they were recorded as cured or improved, and in 25 of these the improved condition was present after a lapse of twelve months. When we bear in mind the effects of operations *per se* and compare the figures presented by Raymond with those of other observers—as for example Pierce Clark, who claims that but a fraction of 1 per cent. recover after removal of the epileptogenic area—we must obviously discount the percentage of so-called cures which have been obtained in the series of 31 cases collected by Raymond and attributed to the removal of the epileptic centre.

The so-called topical treatment of epilepsy is by no means a new one. The extirpation of the epileptical centre was introduced some time ago.

Injection of Eucaine for the Cure of Epilepsy. During the past year White¹ has suggested a mode of treatment essentially topical, but altogether novel, which consists in the injection into and beneath the cerebral cortex of a sterile 2 per cent. solution of eucaine. Too short a time has elapsed since this method has been adopted for us to be able to express an opinion as to the probable permanent results. White was persuaded to give this treatment a trial, with the hopes of securing sedation; that is, of applying the general therapeutic principle of rest in such a way that natural processes may have an opportunity to effect a cure without at the same time disturbing or interfering with the general health. In an editorial² upon this novel procedure, certain speculative theories were advanced as to the manner in which such a procedure could have any permanent effect upon Jacksonian epilepsy. It might have a possible antidotal action upon a theoretical toxin; it might antagonize the action of an autogenous poison or of an invading microbe, or it might act by impressing nutrition in some unknown way. The suggestion is made in this editorial that some experimentation be made not only with cocaine, but with other drugs. White describes his method of operation as follows: "The affected centre is, of course, determined in advance by the most careful study and observation of the case. Its relation to the cranium is indicated by a silver or iodine mark upon the shaven scalp two days before the operation. The scalp is sterilized and re-sterilized three times, at intervals of twelve hours, not only before the trephining, but also before each subsequent application of the treatment. A horseshoe-shaped flap is raised and a half-

¹ University of Pennsylvania Medical Bulletin, vol. xiv., No. 4.

² Philadelphia Medical Journal, June 15, 1901.

inch button of bone removed with a small trephine. The dura is left intact. Thirty minims of a sterile 2 per cent. solution of eucaïne is then injected into the brain substance at the centre of the trephine opening, the point of the needle being introduced about three-quarters of an inch. The needle is gradually withdrawn as the last ten minims of the solution are injected. The flap is replaced. The patient is returned to bed, and on the day of operation and the following day should receive full doses of bromides. At intervals, the proper length of which can only be determined by experience, the scalp having been sterilized as above, the injection is repeated. The patient should be kept in bed at least four hours after each injection, and should take bromides for from one to two days."

Removal of the Sympathetic Ganglion for Epilepsy. There are still surgeons who continue to test the efficiency of the treatment of epilepsy by the excision of the sympathetic ganglion. Braun¹ operated upon nine patients; in one the operation was unilateral, in eight bilateral. The superior ganglion up to the plexus in the region of the inferior thyroid artery and the median ganglion whenever present were removed. As to the immediate results, neither during the section of the nerve nor subsequent thereto was any disturbance of the heart or respiration noticed. A lowering of the upper lid and contraction of the pupil followed section of the nerve as well as paralysis of the vasomotors, which caused some temporary elevation of temperature. As to the immediate mortality of the nine cases, one died on the second day of bronchopneumonia, another suddenly in an epileptic seizure the day on which he was to be discharged from the hospital. Of the remaining seven, too little time had elapsed in three cases to judge of the effect of the operation; while in the remaining four, with whom there was some psychical disturbances, not one had wholly recovered. Braun does not regard the operation as a difficult or dangerous procedure, nor one attended with any serious (either immediate or ultimate) results; but from his rather large experience he has finally concluded that resection of both cervical sympathetic nerves has little or no influence upon the epileptic state.

Traumatic Epilepsy. Keen² removed a piece of bone from beneath the surface of the brain in a patient the subject of epilepsy following a gunshot wound of the head fourteen months before the operation. The patient had been struck on the right side of the vertex of the head by a rifle ball which passed completely through the head and emerged on the other side. Three operations had already been performed with a

¹ Arch. f. klin. Chir., Band lxiv., Heft 3.

² American Journal of the Medical Sciences, July, 1901.

view toward curing the epilepsy before the patient had come under Keen's care. At this time there was left hemiplegia, but no sensory disturbances. The motor area of the cortex was explored and a fragment of bone found beneath the surface of the brain within an abscess cavity containing one-half ounce of pus. At the three operations which had previously been performed the fragment of bone had evidently been missed. Keen draws attention to this and to the fact that the abscess was opened more than a year after the original injury had taken place.

A second rather interesting case was reported by Keen¹ of a lad, aged nineteen years, who in 1892 was thrown from his horse and struck the right side of his head over the occipital and posterior portions of the parietal bones. Some loose fragments of bone were removed immediately after the accident, and a year later a small sequestrum was discharged from the wound. From March, 1899, the patient had been subject to epileptic fits, and in April, 1901, Keen performed an exploratory operation at which a rather interesting condition was found. After removing sufficient bone to expose the brain surface at the site of the previous injury and incising the dura, there appeared a thin, dark-colored sac, which was believed to be the wall of a cyst. This was freely incised, and proved to be the lateral ventricle, the fornix and choroid plexus being clearly visible. The patient recovered from the operation, but not from the epileptic seizures. The case is of peculiar interest in that it demonstrates the—comparatively speaking—harmless nature of what has usually been considered a fatal accident, namely, an extensive wound or wide opening of the lateral ventricle.

CEREBRAL SINUSES.

Wounds. In an analysis of 70 cases of wounds of the great venous sinuses of the brain collected from various sources, Wharton² found that depressed fractures, impact of foreign bodies, and gunshot wounds are the most common causes. The superior longitudinal sinus is the most frequently injured; then the lateral and cavernous, in the order named. The mortality in the series was 64 per cent. In 40 cases of wounds of the superior sinus the mortality was 40 per cent., in 26 of the lateral sinus 69.3 per cent., and then of the cavernous sinus 66.7 per cent. Despite the high mortality attending injuries to the sinus, the older writers, as Brodie, Pott, and Guthrie, curiously enough, did not consider them as being of a very serious nature. The causes of death are hemorrhage, pressure, septic infection, and occasionally embolism. The symptoms are chiefly those of intracranial hemorrhage of any source.

¹ American Journal of the Medical Sciences, July, 1901.

² Annals of Surgery, xxxiv., No. 1.

Hemorrhage due to injury of sinuses might be differentiated from that due to injury of the cerebral or meningeal vessels by observing the character of the blood which escapes, by noting whether the site at which the injuring force was applied corresponds to the position of the sinuses, and whether the symptoms of cerebral compression develop slowly or rapidly. The escape of venous blood from a wound in the neighborhood of the sinuses, with the slow development of pressure symptoms, would lead one to suspect an injury to the sinus. According to Marchant, the symptomatology is so variable that the source of hemorrhage can rarely be diagnosed before operation. Repair of the wounded sinus takes place with or without the obliteration of the canal.

The occlusion of the sinus with a thrombus is followed by little if any disturbance of the function of the brain, owing to the free intercommunication of the various sinuses, and by no other serious consequences, provided the thrombus be not infected. The most important phase of the subject is the treatment. Of the various means of controlling hemorrhage from the sinuses, packing, lateral ligation, ligation in continuity, and suturing are those deserving of the most serious consideration. Wharton is of the opinion that the most satisfactory and generally available method of treatment consists in controlling the bleeding by aseptic gauze packing. Ligation of the venous sinuses presents definite dangers in itself, and is only available in certain wounds, where a free exposure of the injured sinus is possible. It cannot be employed with advantage in ordinary accidental wounds of the sinuses. The application of a lateral ligature to a wound of a sinus is less difficult and dangerous than ligation of the sinus, but is only applicable to small wounds. Suture of sinus wounds is a valuable procedure in a certain class of cases, namely, small wounds which can be freely exposed.

Forceps pressure is also a ready method of controlling hemorrhage from wounds of the sinuses, but possesses no distinct advantages over some of the other methods, and its employment is accompanied by certain dangers. In the discussion that followed the reading of this paper before the Philadelphia Academy of Surgery, Rodman called attention to the comparative infrequency of these injuries, and emphasized the importance of prompt treatment, inasmuch as hemorrhage from the brain is always attended with a greater amount of shock than hemorrhage of the same degree from any other portion of the body. Packing is the most reliable method of controlling hemorrhage, although lateral ligation or suturing are the more ideal. Rodman preferred forcipressure to either of the latter. It can be applied more easily (especially when one must work through a small opening) and more quickly; it is more certain in its immediate effect; it gives the operator a greater sense of security against consecutive hemorrhage, of which

there is always danger should the ligature slip or the sutures cut through after ligation or suturing. On the other hand, Luys,¹ who collected forty-one cases of injury to the superior and sixteen of injury to the lateral sinus, recommends lateral ligature or suture as the best means of arresting hemorrhage. Ligation in continuity, compression with forceps, the packing with strips of catgut, are permissible in certain cases. Of all the measures he regards packing as the most undesirable, since it will of itself cause cerebral compression. He noted in not a few cases of this series that the sinus injured was not the one nearest to the point on the skull where the blow was received, just as in fractures from contrecoup the skull is not injured at the point of impact. Thus, if the patient were struck on the head over the site of the longitudinal sinus, the injury or wound might be inflicted upon the lateral sinus, and *vice versa*.

INTRACRANIAL COMPLICATIONS OF MIDDLE-EAR DISEASE.

Cerebellar Abscess. Recent literature of diseases of the middle ear is replete with the reports of cases illustrating the intracranial complications, and much attention has been paid to their study, more particularly with reference to the diagnosis. So insidious is the onset, so gradual the progress, and so devoid of outward manifestation from the earliest stage of inflammation until that of the fully developed abscess, that the diagnosis is in the majority of instances not only difficult but in many almost impossible. The invasion of the cranial cavity by the infectious material from the auditory canal or the communicating antrum and cells may result in the development of a septic thrombosis of the sinuses, a general suppurative meningitis, or of a cerebral or cerebellar abscess. According to Merkens,² there is no clinical history characteristic of cerebellar abscess. The vertigo said to be so characteristic of cerebellar lesions is met with in affections of other portions of the brain and in diseases of the labyrinth. If, associated with an otitis media suppurativa, there should appear manifestations, chronic in type, which point to a lesion in the posterior fossa, the possibility of a cerebellar abscess should immediately suggest itself; and if, after exposure of the brain, a pathological condition that might account for the symptoms is not found, the diagnosis of a cerebellar abscess becomes now one of greater probability.

Cerebral Abscesses in the temporal region are much more frequent, and, though many may be easily recognized, a number are hard to

¹ Presse Médicale, 1901, No. 48.

² Zeitschrift f. Chirurgie, Band lix., 1901.

differentiate from the other intracranial complications. From the stand-point of the surgeon it is of the utmost importance for him to know whether he is dealing with a diffuse suppurative meningitis, which would be aggravated rather than benefited by operation, or with an abscess. If one is familiar with the pathological anatomy it is not difficult to understand how the lesions of one condition may give rise to symptoms which might be confused with the other, and *vice versa*. Thus a localized meningitis may precede the formation of an abscess, and, even if the meningitis be diffuse, it is not necessarily of uniform severity over the entire brain, but may be more pronounced in certain areas and later involve the brain substance itself, so that circumscribed patches of encephalitis, which may or may not be converted into abscesses, may be the resulting lesion. On the other hand, an abscess pure and simple may later be complicated with œdema of the brain, with encephalitis, or with a serous meningitis.

Hyperpyrexia, with a rapid pulse, manifestations of cerebral irritation, such as restlessness, hallucination, muscular disturbances (excitability, stiffness, contractures, cramps), and sensory disturbances (general hyperæsthesia) point to meningitis. This clinical picture is in marked contrast to the normal temperature, the slow pulse, the paralysis, and the slow, insidious course of an abscess. The duration of the disease is an important diagnostic feature. In the case of an abscess there will be a history running over weeks or months, the condition becoming gradually more and more serious, with or without exacerbations. On the other hand, in meningitis there will be the history of a sudden onset, a sudden change in the clinical picture, which is scarcely ever observed in cerebral abscess of otitic origin. If the abscess be situated in the left side there will be, as Merckens has pointed out, disturbances of speech quite characteristic. The patient can recite after the examiner rather difficult words and fully comprehend their meaning, yet he is unable to designate by the proper word things which he knows full well how to use. Later on word-perception disappears, and he is unable when he hears words to perceive their meaning, or, in addition to word-deafness, there may be word-dumbness, manifestations of which may not make their appearance until months after the operation. These disturbances of speech are pathognomonic of cerebral abscess, and this alone makes it possible with any degree of certainty to distinguish the lesion from meningitis. When one suspects an otitic abscess the speech should be carefully investigated.

Meningitis Serosa and Meningo-encephalitis. Among the other intracranial complications of middle-ear disease should be mentioned meningitis serosa and a meningo-encephalitis. These lesions, according to Merckens, are not necessarily of an infectious nature; they may be

and often are due to the irritant action of the toxins elaborated in the abscess itself, or they may be due to a collateral œdema. If it is possible for the toxins generated in distant parts of the body to cause serous meningitis, as in typhoid fever or pneumonia, it is not hard to understand how a suppurative otitis media or mastoid disease, or, still more, a localized cerebral abscess, may give rise to the same lesion. This so-called serotoxic inflammation may cause an internal hydrocephalus, and may be followed by involvement of the brain itself. The pressure of the internal hydrocephalus and œdematous brain prevents the accumulation of fluid in the subarachnoid space, and in such a case the inflammatory lesion of the meninges would be recognized macroscopically by the hyperæmia. These lesions of the meninges and brain (the serotoxic meningitis and encephalitis) occasion as much pressure as those which are essentially purulent. Often the former condition precedes the latter. On the whole, it may be said that the manifestations of the serous variety are of a milder type than those of the suppurative; that those of the former may terminate in rapid and complete resolution, while those of the latter are usually fatal. It is of the utmost importance when recommending the treatment to be able to distinguish between the serous and suppurative form of meningitis. In the latter class of cases the indications for immediate operation should be regarded as unconditional, while in the former operative intervention is not to be advised, as there would always be the danger of converting what was a serous or non-infective into a suppurative meningitis.

It is not good surgery, however, to be too radical when operating for the relief of these suppurative intracranial complications. Every surgeon is familiar with the sudden fatal termination after operations upon cases manifesting at the time evidences of but a mild meningitis. Paracentesis of the tympanic membrane may promptly relieve temporarily the most threatening symptoms. If there is a mastoiditis the cells should be laid open with the hopes of finding lesions which would account for the symptoms. If no lesion be found one should wait to note the effects of the operation unless the condition grows progressively worse, in which case it is proper to inspect the dura and sinus. Failing to find a condition sufficient to account for the symptoms, the brain and lateral ventricles should be explored.

Sinus Phlebitis and Thrombosis. Second only in importance to cerebral abscess and meningitis as complications of ear disease is sinus phlebitis and thrombosis. According to the statistics compiled by Shepard,¹ the frequency of deaths in proportion to the total suppurative ear diseases is from 1.2 to 2.5 per cent.; the relative frequency of the

¹ Brooklyn Medical Journal, vol. xv., No. 11.

various otitic brain diseases sinus phlebitis is variously estimated at from 35.6 to 41.4 per cent., brain abscess 37.4 to 24.1 per cent., and meningitis 27 to 34.5 per cent. In a series of 388 cases the transverse sinus was involved in 197, the internal jugular vein in 105, the superior petrosal vein in 32, the inferior petrosal vein in 23, the superior longitudinal sinus in 11, the cavernous sinus in 8, and both cavernous sinuses in 10. The symptoms of sinus phlebitis may, for convenience sake, be grouped under three headings: 1. Those due to the mastoid inflammation. 2. Those of cerebral origin, such as headache, vomiting, and constipation, consciousness retained or impaired, hyperæsthesia and crossed paralysis, which Sheppard believes are not indicative of thrombosis, but rather suggestive of meningeal irritation or localized abscess; vertigo, choked disk, and optic neuritis. 3. Those perceivable externally, due to venous obstruction of the sinus and overdistention of the superficial veins, together with inflammation of the veins communicating with the sinus. The mortality, until quite recently, has been very high. Owing to the advances in technique and to the better comprehension of the disease, which has made an earlier and more accurate diagnosis possible, the percentage of recoveries is growing constantly larger. Even when surgical intervention has been deemed advisable and feasible the prognosis is grave, while without operation the situation is almost hopeless; but few well-established cases of spontaneous recovery are on record. Sheppard sums up the situation in the following words: "At the present time we feel that the prognosis in a given case, if recognized in the first stage, is almost uniformly good; that when further advanced, with existing pyæmic manifestations, but without metastasis, there is still an excellent chance for the recovery of the patient; and that, even under the much worse conditions existing after metastases have occurred, and the phlebitis has extended to the internal jugular vein, a small percentage of cases recover. A case is therefore absolutely hopeless only when *in articulo*." As to the diagnosis: "The addition of certain pyæmic manifestations to any of the four following ear conditions should be considered strongly suggestive: 1. A more or less profuse chronic otorrhœa which has rather suddenly lessened or ceased. 2. A chronic middle-ear suppuration, with such scanty secretion as perhaps to be unknown to the patient, and discoverable only by ocular inspection under illumination of the external canal and tympanum. 3. An acute middle-ear suppuration attended with more or less unmistakable evidences of mastoid involvement. 4. An acute middle-ear suppuration in which the discharge has gradually ceased from two weeks to two or three months previously, attended with and followed by more or less obscure and slowly lessening symptoms of mastoiditis." Sheppard holds very radical views with reference to the ligation of the

internal jugular vein in the treatment of sinus thrombosis, and supports his opinion with *a priori* reasoning by his experience and statistics. Quoting from the statistics of Viereck, of 94 cases of pure sinus thrombosis, of which 40 were ligated, 6 died of pyæmia (15 per cent.), 6 had a prolonged recovery, with metastases (15 per cent.), and 70 recovered. Of the 54 which were not ligated 13 died from pyæmia (24 per cent.), 16 had a prolonged convalescence, 11 with metastases, and 46 wholly recovered. The advantage of having closed against infection the main entrance to the general circulation is so great that in every case in which the diagnosis is reasonably certain ligation and resection of the internal jugular vein should constitute the first step of each operation. The operator then proceeds in the customary way to explore the region of the mastoid and sinuses.

FACE.

Nose. **EPISTAXIS.** The most efficacious remedy for the control of epistaxis is the application of the extract of suprarenal gland. Within a few seconds after the application it will cause a bleaching of the mucous membrane, the result of its action as a powerful vasoconstrictor. In individuals beyond middle age, where the hemorrhage is due to long-continued arterial pressure, to sudden cardiac failure, or to engorgements of the veins resulting from the inability of an overtaxed heart to overcome the resistance of the contracted arterioles, Coates' recommends the administration of such remedies as will relax the walls of the contracted arterioles, and in so doing relieve the venous congestion, and to this end he gives nitroglycerin and nitrite of amyl. The use of cardiac tonics, such as strychnine or strophanthus, are distinctly contraindicated until the capillaries and arterioles are dilated and pervious.

SADDLE NOSE. Gwyer² describes an operation for saddle nose, which consists essentially in filling in the depression with a flap composed of the subcutaneous tissue and, perhaps, cartilage, which is dissected up from the tip of the nose to the lower margin of the depression. He prefers this operation to the employment of foreign material and to other plastic operations, on the ground that the connection is made with living attached tissue, having its own blood-supply, and also because of the ability to correct minor deformities at the same time. The operation is thus described in detail:

"A longitudinal incision is started in the middle line at or near the root of the nose, depending on the amount and situation of the deform-

¹ Lancet, April 20, 1901.

² Annals of Surgery, August, 1901.

ity ; it is carried downward toward the tip of the nose. At a variable point, depending on conditions to be mentioned hereafter, the line of incision divides, the two lines separating more or less and coming together again below the tip, forming an ellipse. This incision is carried through the skin, and the skin included in the ellipse is removed. The skin is then dissected loose for a sufficient distance on either side, especially in the region of the deformity. The next step is to dissect up a flap composed of the subcutaneous tissue and, perhaps, cartilage, starting at or below the tip and raising the flap as far as the lower end of the depression, leaving it attached by a broad base at its upper part. The flap is turned upward and laid with its outer surface upon the exposed cellular tissue at the upper part of the incision corresponding to the depression. The flap is made thicker in the middle than at the sides and ends, the thickest part, when it is placed in position, corresponding to the depressed part. It is best not to carry the upper end of the incision too high, but, having loosened the skin at that point, to tuck the free end of the flap under it ; such a course makes less scar, and union is apt to be more prompt and more firm. After raising this flap, a portion of the cartilages lying on each side of the median line of the tip is removed, the amount depending on the spread of the nostrils. The suturing should be done with a fine, small needle, preferably with a horse-hair. The approximation should be very accurate and not too tight. The stitches should be removed as soon as possible. The quantity of skin removed in the ellipse depends on the amount of broadening of the tip and alæ. A narrow piece should be first removed, and subsequently more, if necessary. The skin is then approximated by very fine sutures throughout the length of the incision, a figure-of-eight suture being used at the tip to approximate the deeper parts, and the wound is covered by a light dressing of collodion, iodoform, and gauze."

FACIAL NERVE. An important article upon the subject of the treatment of facial paralysis has been contributed by Manasse. The latter conducted a series of experiments upon dogs to determine the histological and functional results following the establishment of anastomosis between the spinal accessory and the facial nerves. In a relatively short time there were evidences of restoration of function and of the disappearance of the paralysis. Within the first three months there was absolutely no reaction to the faradic current, but beginning with the fourth month evidences of regeneration of the nerve fibres appeared. The author discussed in some detail the methods of effecting histological union between two nerves, and speculates upon the various ways whereby the restoration of physiological activity of the facial nerve after grafting is to be explained. Up to the present time we have no means at our

command of remedying the disfigurement following traumatic facial paralysis, and it is to be hoped that the operation suggested by Manasse and successfully carried out upon the dog may prove to be applicable to the human subject. The operation would, for several reasons, be difficult of performance, and on account of the delicacy of the structures would require great dexterity; but these do not constitute any valid objections or contraindications. In lieu of the absence of any other possible remedy the operation demands consideration and deserves a thorough trial.

EPITHELIOMA OF THE CHEEK. In a paper presented to the Surgical Section of the International Medical Congress, Morestin¹ goes into the subject of epithelioma originating in the mucous surface of the cheek, to the exclusion of malignant growths which take their origin from the lips or tongue. The latter is a very common seat for malignant growths of the buccal cavity, the former a very unusual one. In the twelve cases upon which the author bases his observations but one was a female; all were addicted to the free use of tobacco, most of them being inveterate smokers. The course of the growth is usually rapid. Beginning in the inferior cul-de-sac, it rapidly invades the alveolar process and tissues of the cheek until the skin becomes involved, and a cancerous fistula, characteristic of cancer in this locality, is established. The submaxillary lymphatic glands are invaded at an early period, and subperiosteal abscesses and erysipelas have been noted as complications. Owing to the rapidity of the growth the prognosis is always grave, as within a few months the case will have become inoperable.

Morestin² calls attention to the peculiar pallor which he observed in those subjects already cachectic, and regards it as a distinct contraindication to operation. The usual yellowish or sallow hue of cachexia is not observed, probably because of the comparatively short duration of the affection. In the four cases which submitted to operation, all died within eight months, one on the day of the operation. The operation, which includes the removal of the metastatic glands as well as the inferior maxilla, is conducted in the following way: Two incisions run from the commissure of the mouth to the sternomastoid muscle at the height of the large horn of the hyoid bone. The space between these incisions varies with the amount of integument to be removed. The tumor is now attacked by the submaxillary route. The glands are extirpated first of all. The facial artery and vein are tied. The adhesions between the tumor and jaw are not disturbed, but the cancerous mass is very carefully detached from the structures which lie beneath. The digastric and mylohyoid muscles are thus exposed in the floor of

¹ Langenbeck's Archives, Band lxii., Heft 4.

² Journal des Praticiens, March 16, 1901.

the wound, and the submental artery is tied. The skin is now dissected upward from the superior border of the wound, the tissues of the cheek divided from before backward, and the lower attachment of the masseter is divided. The inferior maxilla is now sawn through in front near the median line, brought forward, and the floor of the mouth detached. The ascending ramus of the jaw is similarly detached, from before backward, above the level of the dental crowns. The inferior dental artery is now tied as it enters the inferior maxilla. There only remains for the complete liberation of the cancerous mass the division of the internal pterygoid attachments. To close the wound the mucosa of the floor of the mouth is stripped off up to the tongue, brought upward, and joined to the mucosa of the cheek by sutures. The cutaneous breach is similarly repaired. When the case has reached the inoperable stage, palliative measures will contribute to the comfort of the patient: antiseptic mouth washes, diet of liquid or soft, non-irritating foods, the application of anaesthetics to the ulcerated areas, and the hypodermic injections of morphine.

NOMA. An unusual series of cases of noma occurred in the Albany Orphan Asylum,¹ following an epidemic of measles; of the sixteen recorded cases the mouth alone was affected in four, the mouth and other parts in three, and in the remainder the vulva and rectum. Although the exciting cause of this series of cases was evident, the commonly accepted predisposing cause—bad hygienic surroundings—was not a factor. An investigation of the diet, the ventilation, the plumbing, and the general hygienic conditions proved them all to be excellent. As to the result of the bacteriological examination, mixed cultures were found in the superficial sloughs and growths and the deeper parts. Of the nine cases in which the bacteriological examination was made the following results were noted: In all cases one organism, and one alone, was constantly present in large numbers in cover-slips. It averaged one-half micron in breadth, and varied from five to twenty microns or even more in length. The short forms were usually bent, the long forms curled or wavy. The organism stained rather poorly with gentian violet, much better with carbol-fuchsin. It did not decolorize by Gram's, though it stained faintly by his method. It showed no branching. In smears from the early cases this was almost the only organism present. As the process grew older the cover-slips showed a greater mixture of organisms. Those from the latter stages showed, beside the thread-like organism, short, thick bacilli, decolorizing by Gram's, and also cocci either in groups or chains, which did not decolorize by Gram's method. All of the cultures failed to show

¹ American Journal of the Medical Sciences, November, 1901.

the thread-like organism. The colon bacillus was present in all cases, as were some of the pus cocci, the streptococcus pyogenes occasionally, much more commonly the staphylococcus aureus. In all probability noma exists as a simple infection, but later becomes a mixed one; and, while not always due to the same organism, is most frequently due to a long, thread-like organism of the leptothrix type, which does not grow in ordinary media.

The ages of the children affected ranged from three to twelve years, and in all but two the cases developed in the girls' dormitory, although there were almost twice as many cases of measles in the boys' dormitory. As soon as thorough isolation was established no new cases developed. Of the seven fatal cases pneumonia was the direct cause of death in five.

The general treatment was stimulating, consisting in the administration of alcohol, iron, quinine, strychnine, nitroglycerin, and concentrated nourishment. The local treatment consisted of cleanliness, frequent douching with 50 per cent. boric acid solution, then with pure hydrogen dioxide, and continued wet dressings of Labarraque's solution. When the destruction was not too great, the use of the Paquelin cautery under chloroform seemed to stop the process.

The treatment of noma or cancrum oris to be effectual must be promptly applied and radical. Cressy¹ reports the successful treatment of a case by excision and cauterization. He cut through the upper lip and cheek very nearly as far as the zygoma, the knife passing right through the sloughing mass, which was dissected away from the cheek and then from the gum. The denteline cautery was freely applied to all the tissues laid bare and the edges of the incision united with sutures. The cheek healed by primary union. The cauterized surface inside came away in sloughs, and then granulated rapidly. The result was a linear scar across the cheek, somewhat fixed to the upper maxilla, with consequent immobility of the upper part of the cheek. The exposure of the lesion by division of the cheek is regarded as a very important step in the operation, inasmuch as it renders the affected tissues quite accessible. Only by early and radical interference with knife and cautery can the prognosis be anything but grave in this so fatal class of cases. Owing to the fact that the diphtheria bacillus has been found in pure cultures in a certain number of cases of cancrum oris the early administration of antitoxin has been very properly recommended, and in some cases has seemed to have an effect almost specific; and inasmuch as there are no risks entailed in the use of the antitoxin, it would hardly be justifiable to wait for a report from the bacteriologist.

¹ Annals of Surgery, August, 1901.

X-RAY TREATMENT OF SKIN CANCERS. It would seem as though we had in the X-ray an efficacious treatment for certain forms of cancer, particularly the superficial external variety. Sequeira¹ has applied this treatment to twelve cases of rodent ulcer, all of which were deemed unsuitable for operation, or in which the patients refused operative measures. Of these, one was a very severe case, one eye and part of the nose having been destroyed and the antrum of Highmore opened; after a fortnight the ulcerative process had been arrested and cicatrization begun. The results taken as a whole have exceeded anticipations, and in no case has there been a disappointing result; four of the cases are entirely well, and eight are still under treatment, and of these, four are in various stages of healing. It is too early for the author to predict as to the permanence of the results; suffice it to say that at present the immediate results are all that could be wished for. Nor is he able to speak positively as to the process induced by the X-ray in the arrest of malignant disease. A histological study of some of the specimens which have been removed for examination may throw some light on this phase of the question. Williams² has been engaged in making observations upon the effect of the X-ray upon both the external as well as the internal forms of cancer. The external lesions which he has had under treatment include epidermoid cancers, typical epitheliomata, rodent ulcers, and cases which had the clinical appearance of beginning cancers, but which under the microscope were found to be plasmoma or simply cases of ulceration and necrosis or chronic inflammatory tissue. The results of the application of the X-ray in Williams' hands were brilliant; in practically every case the growth either has already disappeared or is now disappearing. Not only is the treatment effectual in that it removes the growth, but in that it yields excellent cosmetic results and affords absolute relief from pain. A certain amount of precaution must be taken in the treatment to prevent an X-ray burn, either of the lesion itself or of the surrounding healthy tissues, and to this end the surrounding parts must be protected from the action of the ray, and the treatment pursued not too vigorously. To whatever the results are to be attributed, they are in no way dependent upon the production of a burn. Photographs of four cases which have undergone resolution illustrate the article. One is of an epidermoid cancer of the lips, one of an epithelioma of the eyelid treated without causing the slightest trouble to the eyelid, a third of a rodent ulcer on the side of the nose and cheek, and a fourth of an epithelioma of the hand. It may be claimed for this treatment that it causes no pain; that resolu-

¹ British Medical Journal, February 9 and 16, 1901.

² Journal of the American Medical Association, September 14, 1901.

tion is effected without a burn; that the treatment can be carried on without any interference with the patient's work or occupation, and with excellent cosmetic results; but, on the other hand, it has the disadvantage of requiring an expensive apparatus, and encourages delay beyond the time when the lesion may be regarded as operable.

In this connection might be mentioned a case reported by Lieberthal,¹ in which an epithelioma developed in the site of a healed lupus vulgaris. The exposures were made at first twice a week, and later every day for a period of four months; the primary current used for the induction of the secondary was 8 and 12 volts and $1\frac{1}{2}$ ampères; interruptions averaged 800 per minute, the distance from the exposed surface varying from 3 to 6 inches, and the time of exposure from ten to twenty-five minutes. After the third exposure there was a noticeable diminution of the secretion, and at times the tumor appeared perfectly dry. The growth, however, was not checked, and the treatment was discontinued.

JAW.

Irreducible Luxation of the Inferior Maxilla. A novel method has been described by Kramer² for the treatment of irreducible luxation of the inferior maxilla. The method is based on the assumption that the overstretched muscular and ligamentous fibres, particularly those of the masseter, external pterygoid, and internal lateral ligament, offer the principal obstacles to reduction. A horizontal incision is made along the border of the zygoma, and from the middle of a second incision running downward perpendicular to the first. The fibres of the external pterygoid muscle and external lateral ligament are separated and the joint exposed to view. Without opening the capsule reduction may be made by making pressure directly downward and backward. This operation is preferable to the only hitherto recommended operative treatment, which depends for its success upon the resection of the coronoid process.

Removal of the Upper and Lower Jaws. Nothing worthy of notice has recently been contributed to the technique of excision of either the superior or inferior maxillary bones. The question of the preliminary ligation of the carotid artery is taken up by Schlatter,³ who summarizes the observations obtained from his own resections and from a study of the literature in the following words: 1. By the application of a preliminary ligature the hemorrhage, as well as the danger from blood aspiration, is markedly diminished. 2. This ligation is

¹ Journal of the American Medical Association, May 25, 1901.

² Centralblatt f. Chirurgie, 1901, No. 14.

³ Philadelphia Medical Journal, April 13, 1901.

highly recommendable in all anæmic individuals and in those whose vitality has been lowered from cachexia and hemorrhages, provided they do not suffer from diseases of the bloodvessels, particularly arteriosclerosis. Exposing the bifurcation of the carotid in advanced cases is in itself indicated for the purpose of extirpating the lymphatic glands, which in this region are generally the first attacked by metastasis. 3. In by far the most cases ligation of the external carotid alone will suffice; the latter should be permanent ligation. Conducted aseptically, the proceeding is without danger. The ligature can be applied by enlarging above the incision which has been made for exposing the bifurcation. 4. In exceptional cases it becomes imperative to ligate the common carotid, which, if done temporarily, seems to be less dangerous than a permanent ligation. The author states that the limitations of this operation are greater in actual practice than at first appears.

As a precautionary measure calculated to prevent occurrences of asphyxia during the administration of the anæsthetic, or during the convalescence after certain operations upon the lower jaw and in the mouth, a loop should be passed around the hyoid bone, upon which, when the occasion demands, the anæsthetizer or the patient can make traction. One of Fenger's¹ patients died suddenly during the night after an extirpation of the lower jaw, including the middle portion of the bone, together with the muscles of the floor of the mouth. No cause other than asphyxia fully explained this unlooked-for result. In order to prevent the recurrence of such an accident and to assist the anæsthetizer during narcosis, Fenger recommends the adoption of this preliminary measure. After resection of only one-half of the lower maxilla a loop passed through the anterior portion of the divided bone is sufficient. If dyspnœa develops relief will be afforded the patient by making traction upon the loop, but when all the muscles of the floor of the mouth—those running from the body of the inferior maxilla back to the tongue and hyoid bone—are removed, the tongue and larynx, together with the epiglottis, will have lost all their attachment to the maxilla, so that some other method must be devised for preventing the patient suffocating as a result of the tongue and larynx falling back against the wall of the pharynx. In a series of observations upon the cadaver made by exposing the pharynx through an opening in the base of the skull, after removal of the calvarium and brain, Kappeler found that traction upon the hyoid was the only manipulation that made the entire posterior commissure of the larynx with the arytenoid cartilages visible, and the entrance to the larynx therefore free. That such other measures as lifting the chin upward, making traction upon the tongue,

¹ *Annals of Surgery*, June, 1901.

or lifting the lower jaw forward are not as effective as making traction upon the hyoid bone was readily demonstrated by the following observations upon the cadaver: "The head is placed in a horizontal position or on a small pillow, whereupon the soft palate can be seen lying against the posterior wall of the pharynx, either entirely so or separated from it by a narrow slit through which the upper ridge of the epiglottis may be seen. If the chin is now lifted up, the mouth being closed, the soft palate moves forward away from the wall of the pharynx, and we see the root of the tongue and the upper border of the epiglottis; but its whole posterior surface still lies close to the posterior wall of the pharynx. If the tongue is now pulled forward out of the mouth in front of the teeth it is seen that the posterior part of the tongue moves forward away from the epiglottis, and the median glosso-epiglottic ligaments come into view, while the epiglottis is either not moved at all or makes only a slight forward movement. If the lower jaw is now lifted forward by pushing the descending rami upward when the patient is recumbent, or forward when the patient is upright, the epiglottis moves forward, so as to free the entire upper (anterior) half of the entrance to the larynx. It will thus be seen that this manipulation alone is much more effective than pulling out the tongue. If the tongue is now pulled forward while the jaw is lifted forward, the epiglottis is moved a little forward, but only very little, and not beyond the border of the soft palate.

"If the hyoid bone is now pulled forward, either by the sharp hook of Kappeler or by the loop as devised by me, the mouth closed, and the tongue untouched, the posterior (lower) half of the entrance to the larynx is made free, and the anterior (upper) half of the larynx is covered by the root of the tongue, which also covers the epiglottis. If, in addition to the pulling forward of the hyoid bone, traction is made on the tongue, the whole of the entrance to the larynx is made free. The tongue and epiglottis have disappeared forward under the soft palate. It is really the pulling forward of the hyoid bone that frees the entrance to the larynx from the wall of the pharynx, with room to spare."

The loop of silk is passed in the following way: a small longitudinal incision is made over the middle of the hyoid bone and an aneurism needle armed with silk made to encircle the bone. A small pad of iodoform gauze is packed in the wound and the loop tied over it, the ends being left long enough to permit of manipulation by the anæsthetizer, patient, or nurse.

The loop is removed usually on the third or fourth day—that is, as soon as it is evident that the patient can breathe without difficulty in any position.

VENOUS STASIS FOLLOWING LIGATION OF THE INTERNAL JUGULAR VEIN. Kummer¹ met with an unusual complication consecutive to the ligation of the internal jugular vein during a resection of the lower jaw. After the operation the patient remained comatose, the pulse became irregular, the coma deepened, and the patient died within five hours. The autopsy revealed evidences of venous stasis, and in the region of the frontal lobes there was an area of discoloration, about the size of a five-franc piece, of reddish hue, involving the entire thickness of the cortex.

Angina Ludovici. Ross² reports two cases of that form of cellulitis of the floor of the mouth first described by Ludwig in 1863, now known as angina ludovici. In one the infection arose from a necrotic and undeveloped wisdom tooth, spreading so rapidly that within twelve hours of the onset of the attack operative intervention was demanded. The wisdom tooth was pried away from the last molar, affording an avenue of escape for the pent-up pus and gas. The symptoms rapidly subsided, only to occur again, on this occasion the offending tooth being chiselled out. In the second case the patient had had a toothache four days before his admission to the hospital, at which time the swelling was confined to the submaxillary region; within a few hours the swelling had extended from the angle of the jaw on the left to that on the right, and down the neck to the clavicle. Periodic attacks of dyspnoea developed, and were only relieved by violent voluntary inspiration. Despite the relief of tension afforded by free incisions into the sublingual tissues, within forty-eight hours the inflammatory process had spread until it extended upward as far as the zygomatic arches and downward to the midsternal region. Fluctuation could now be elicited for the first time just below the symphysis of the jaw. The abscess was opened by free incisions under chloroform, and during the procedure the patient stopped breathing, and a tracheotomy was performed. Owing to the congestion and consequent swelling of the larynx and pharynx, the patient developed both aphonia and dysphagia. With the exception of a slight bronchitis convalescence was uninterrupted. The cultures proved the infection to be due to the staphylococcus pyogenes aureus and streptococcus pyogenes. The pathological findings would seem to indicate that the process was akin to that of erysipelas. If this be true, patients so afflicted should always be isolated.

¹ Bull. et Mém. de la Soc. de Chir. de Paris, T. xxiv. p. 541.

² Annals of Surgery, vol. xxxiii., No. 6.

THYROID GLAND.

Pathogenesis of Enlargements of the Thyroid Gland. Speculations as to the pathogenesis of enlargements of thyroid glands not due to neoplasms are still rife, and, until some more definite conclusions are arrived at, every form of treatment must, for the time being, rest upon the flimsy foundations of empiricism. It would seem as though our knowledge of the etiology of cretinism and of its response to the administration of thyroid extract should have afforded us a sufficient working basis upon which to construct theories as to the pathology, or rather pathogenesis, of those other affections associated with enlargement of the thyroid gland; and yet to-day we must acknowledge that we have failed in fathoming the depths of this seemingly obtuse problem. Contradictory statements, results by no means uniform, theories radically opposed one to the other, are constantly making their appearance in the literature. The function of the parathyroid bodies, their relations to the thyroid gland itself, the part played by the cervical sympathetic—these are only a few of the subjects that have been made the object of study. Are the parathyroid bodies necessary for the economy of the system? Are they the secretory organs, and is the thyroid gland simply a storehouse or reservoir for their secretory products? Are the pathological changes in the gland due primarily to disturbance of the sympathetic system, or are the phenomena manifested through the sympathetic nerves the consequence of its overstimulation by the secretion of the thyroid gland? Or is the primary lesion back of all this in the cerebro-spinal system?

Quite the most interesting and at the same time valuable contribution to the literature of the subject is to be found in the Erasmus Wilson lectures on the Pathology and Diseases of the Thyroid Gland, by Walter Edmunds.¹ He first describes the histological anatomy of the thyroid and parathyroid glands. The latter, four in number, one above and behind, another in front and below each lobe, are developed prior to the thyroid gland, and differ from them histologically in that they are composed almost exclusively of cells having no vesicles and, therefore, little if any colloid material. These parathyroid bodies are not to be mistaken for the accessory thyroids, which resemble in structure the thyroid gland itself. Much space is devoted to the observations which have been made in studying the effects of experimental work upon animals, particularly dogs, rabbits, and monkeys. Total extirpation of the thyroid and parathyroid bodies in dogs was followed by the death of the dog on or about the fifth day. During the days preceding death

¹ *Lancet*, May 11, 18 and 25, 1901.

muscular twitchings, convulsions, elevation of temperature, rapid respiration, falling out of the hair, listlessness, unstable equilibrium, albuminuria and, less frequently, glycosuria were some of the effects noted. When only two parathyroids and one lobe of the thyroid were removed the dog did not die, but after the subsequent removal of the remaining lobes of the thyroid and the remaining parathyroids the animal succumbed. The animals seemed to suffer no effect from the removal of all but one parathyroid body, but if the latter were subsequently removed the animal died. Complete parathyroidectomy was followed by death in four cases, by temporary disturbance in three, and by negative results in two. It was noted that after removal of three of these parathyroid bodies and the thyroid gland the remaining body underwent hypertrophy, but was not converted into thyroid tissue. When the parathyroids alone were removed the thyroid lobes underwent, as it were, a compensatory hypertrophy; there was a diminution in the colloid material, which was replaced by a watery secretion, and the secretory cells became columnar; the lobes did not become enlarged, but seemed to diminish in size. From these experiments one would naturally infer that the parathyroid bodies are the secretory organs and that the function of the thyroid gland is that of a reservoir, if not wholly, at least in greater part; and if we can draw any analogy between dog and man it would seem as though the reputed dangers attending complete extirpation of the gland were imaginary rather than real. The results, as affecting the life of the animal, of the three series of animal experimentations are briefly these: (1) Complete extirpation of thyroid and parathyroids was followed by death on or about the fifth day; (2) removal of two parathyroids and one lobe of the thyroid was not fatal; (3) complete parathyroidectomy alone was fatal in about 50 per cent. of cases, causing in the balance either temporary disturbance or no ill effects whatever (the lack of uniformity in these results is attributed to the difficulty of removing all the parathyroid tissue); (4) partial parathyroidectomy was fatal in but one of seven cases, and caused temporary disturbance in four. Among the observations that were made during the course of these experiments were those upon the ocular manifestations. The author concludes "that excision of the thyroid gland and the parathyroid glands produces enophthalmos, with narrowing of the palpebral fissures; total thyroidectomy would seem to produce the same, and so also (if it produces symptoms) does excision of the thyroid gland proper; but certain operations not fatal at the time, and especially those in which the parathyroids are interfered with, may be followed by exophthalmos, with widening of the palpebral fissures. The same operation may be followed by first widening and later narrowing, but I never saw the reverse, at least not as a permanency. It

will be noted that these changes tend to support the suspicion that the parathyroid glands are involved in the pathology of Graves' disease."

Sympathetic Nerves and the Thyroid Gland. Whether the sympathetic fibres exert any influence upon the secretion has been a mooted question, and until a positive answer can be obtained we cannot place our stamp of approval upon that method of treating thyroid affections depending for its success upon the removal of the sympathetic. Exner, after Schiff, Horsley, Katzenstein, and others had failed, succeeded in obtaining positive results after disturbing the innervation of the gland; and Edmunds, repeating Exner's experiments, obtained similar results. A portion of the superior laryngeal and vago-sympathetic nerves of a dog were removed on one side and on the opposite side the thyroid lobe, together with its parathyroid body. The results were as follows: Of nine cases three died, four had athyroidic symptoms, and two no symptoms at all. Five specimens were submitted to microscopical examination, and in every one of these the colloid material had disappeared, and in four the secreting cells had multiplied into the cavity of the vesicles. These results, clinical and microscopical, make it clear that the interference with the nerve-supply produces very serious symptoms, and when we come to consider the pathology of thyroid disease we must be prepared to admit the possibility of defective innervation being the cause of serious symptoms and pathological changes.

Results of the withdrawal of the thyroid secretion from the system, either by removal of the thyroid and parathyroid bodies or by interfering with the innervation of these structures, has already been demonstrated. In studying the reversed condition, namely, the result of the action of an increased amount of thyroid secretion upon the economy, Edmunds administered to dogs large quantities of thyroid extract without any obvious effect. In monkeys, however, the administration of the extract produced exophthalmos, widening of the palpebral fissure, dilatation of the pupils, emaciation and weakness, falling out of the hair in patches, and paralysis of one or more extremities. In order to determine whether these results were due to the action of the extract upon the cervical sympathetics, he administered thyroid extract to two monkeys in which the cervical fibres had been excised on one side; twelve days later he found that on the unoperated side there were exophthalmos, dilatation of the pupils, and widening of the palpebral fissure; while on the other side the pupil was not dilated, nor was the eyeball prominent, and the palpebral fissure was narrow. The effects of the administration of the thyroid extract upon the human subject are very generally known.

Pathology of Graves' Disease. As yet comparatively few observations have been made upon the action of the parathyroid gland. It

has, as yet, proved of no therapeutic value in the human subject, although beneficial results have been produced undoubtedly in animals that have been deprived of their parathyroid glands.

With respect to the pathology of Graves' disease, under which Edmunds includes all cases of goitre with symptoms not explained by pressure, he holds to the opinion that the secretion from the goitre is the cause of all the symptoms, and that, therefore, the primary lesion is in the thyroid or parathyroid glands. As far as his experience goes, the thyroid gland is always enlarged in Graves' disease and in a state of active secretion; the secretion, however, differs somewhat from that in healthy subjects, having proportionately less colloid, and in some cases no colloid material at all. The microscopical examination of the glands furthermore present certain changes which are identical with those of the compensatory hypertrophy as seen in animals after partial removal experiments; "indeed, the resemblance is so close as to lead to the conclusion that the changes in the thyroid gland of Graves' disease are also compensatory in character; in other words, that they are secondary to some defect elsewhere in the system; that defect may possibly be in the parathyroid glands, but there is no evidence on that point either way at present." The opinion of Edmunds corresponds very closely to that of Gley,¹ who contends that exophthalmic goitre is due to alteration of the thyroid apparatus, involving, in the first place, functional disturbances of the parathyroid bodies, and that the symptoms in exophthalmic goitre are produced by the entrance into the organism of toxic substances having a selective action on the sympathetic system.

Tumors of the Thyroid Gland. But few of the enlargements of the thyroid gland are due to the presence of new-growths, the great majority being simple hyperplasia of the glandular elements in one or both lobes, with or without the development of cysts. The majority of new-growths, however, are malignant, primary carcinoma being more common than primary sarcoma.

Lartigau² was able to collect fifty-one cases of sarcoma of the thyroid from the literature, and, although the condition is rare, he believes that it is of more common occurrence than statistics show. He reports a case coming under his own observation of a married woman, aged forty-five years, who had noticed eight years ago a lump in the middle of her neck which grew slowly until it reached the size of a hen's egg. The tumor proved upon examination to be an angiosarcoma; the patient died, apparently from asphyxia, on the nineteenth day after the operation. There were no metastatic lesions. From an analysis of his collection of

¹ British Medical Journal, September 21, 1901.

² American Journal of the Medical Sciences, August, 1901.

fifty-one cases Lartigau found that sarcoma of the thyroid is commonly associated with goitre, and more common in persons between the ages of forty and sixty years who show a higher percentage of previous goitre than younger individuals. Unlike sarcoma elsewhere, it is met with oftener in late than in early life; taking its origin most frequently from the right lobe, its subsequent course is relatively acute, and soon involves, either by pressure or by infiltration, the trachea and larynx. Histologically, the round and spindle or mixed cells are the most common, although, comparatively speaking, angiosarcomata are not rare.

The number of malignant neoplasms involving the thyroid gland is not very large, so that we deem it advisable to place on record the few cases that come to our notice. We find two cases of carcinoma of the thyroid gland, or more properly cancerous goitre, reported by Maurice Patek,¹ both occurring in women past middle age, both patients having had goitre for a number of years. Neither of the two was operated upon. In one the tumor proved to having taken its origin from the wall of an old cyst.

Of interest on account of its rarity is Pettersson's² case of cyst-adenoma papilliferum of the accessory thyroid gland. His patient, a man of some fifty-three years, had noticed for some time a nodule on one side of the neck. At the operation a number of growths were found on both sides of the neck, extending down the mastoid process to the clavicle, which proved upon examination to be mostly cysts covered with low columnar epithelium and filled with colloid and papillary excrescences. These growths had apparently taken their origin from islands or strings of epithelium, which are said by Wolfier to form their starting-point. In making a differential diagnosis there are three possibilities: cysts from branchial clefts, cysts from the submaxillary gland, and cysts from the thyroid and its accessories.

Distribution of Goitre. To those interested in the distribution of goitre as having any bearing on the etiology, it might be of interest to read the conclusions arrived at by Charlton³ from his observations on the island of Montreal: 1. There is a relationship between the habitual water-supply of the inhabitants and the prevalence of goitre on the island. 2. Those living in the city of Montreal and along the shores of the island and who drink Ottawa river water are unaffected. 3. Those living in the country, and who are dependent upon wells relatively shallow for their water-supply, are liable to be affected. 4. In districts such as Point-aux-Trembles, where formerly the greater number of the

¹ Gazette des Hôpitaux Civils et Militaires, March 9 and April 11, 1901.

² Upsala Lakäreforenings Förhandlingar, 1901, No. 8.

³ Montreal Medical Journal, August, 1901.

inhabitants drank well-water and goitre was common, there has been a considerable reduction in the number of cases of goitre since river-water has been supplied to the inhabitants. 5. The drinking of water from shallow wells is not the only factor in causing the disease, as is instanced in the parish of St. Laurent. 6. A certain relationship would, however, appear to exist between the nature of the soil, the shallowness of the wells, and the prevalence of goitre. When the overlying soil is glacial clay, although the wells are shallow, goitre does not occur; where, on the other hand, the soil is sandy and porous, as in the parishes of St. Anne and St. Leonard, goitre is very common, although there is considerable variation in the depth of the wells. 7. So far as the present observation goes, the nature of the underlying rock, which from one end of the island to the other is silurian limestone, is not the essential factor in the causation of goitre, although we may conclude from the observations made in Switzerland, Norway, and in the Valley of the St. Lawrence, that it is a strong predisposing factor.

Treatment of Goitre. The difficulties that harass the surgeon who faithfully tries to classify his cases of goitre into the operative and non-operative have already been alluded to in my introduction to the pathology of this subject. Chaos is perhaps too strong a word, but we must admit of the existence at least of confusion in the subject of the treatment of enlargements of the thyroid gland. It will be conceded, I think, by most surgeons, conservative or radical, that we can name at least four positive indications for operative intervention: (1) Malignant neoplasms; (2) enlargements causing distressing dysphagia or dyspnoea; (3) cases of Basedow's disease which do not respond to medical treatment, and possibly (4) rapidly growing tumors in the young. There will be found some who recommend operative intervention in a much broader class of cases, while others, again, who would lessen the scope of the indications for the operation. I am not prepared to express an opinion offhand in favor of the extremist either in the direction of radicalism or conservatism, but I can call your attention to the fact that the greater the experience of the operator the more radical are his views. This need not of necessity be interpreted as an argument in his favor, because in some instances these radical views are born of confidence in one's dexterity rather than of good judgment or discriminating power. In looking over the statistics that have been published during the past year I find Kocher's report upon the completion of his second thousand, Kraske's report on the results of four hundred operations, Riedel upon some four hundred cases, and Shield with a paltry forty-two, although as compared with the other English or with American surgeons Shield has had a comparatively large experience.

INDICATIONS FOR OPERATION. Kocher recommends operation for all malignant cases, for all those with embarrassing respiration, and for all cystic and colloid goitres. Edmunds contends that in sporadic cases it seems now to be clearly established that the administration of thyroid is the best treatment. Palliative measures should always be tried in Graves' disease before suggesting operative intervention.

PALLIATIVE REMEDIES. Kocher has obtained quite as good results with preparations of iodine as with thyroid extract, and believes that, despite the results that have followed improvement in technique, we dare not give up our efforts to influence the development of goitre by prophylactic or medicinal measures. His son, Dr. Albert Kocher, has for some time been studying the effect of phosphorus on the activity of the gland, and has discovered that by the administration of iodine or phosphorus he can influence the quantity of each as they exist in the thyroid gland, for when iodine was administered the proportion of phosphorus decreased, and *vice versa*. Knowledge of this therapeutic discovery can be applied to the treatment of Basedow's disease and to a lesser degree of colloid goitres, in both of which the proportion of iodine is low. Edmunds recommends the use of thyroid extract in sporadic cases, although admitting the variability of its results. In Basedow's disease such measures as rest, change of air, belladonna, bromide of potassium and iodine should be given a very fair trial. Marmaduke Shield administers 5 grains of potassium iodide and 1 minim of tincture of iodine, sometimes increasing the dose to 3 minims. In some cases thyroid extract was tried, with much benefit, and in one case hydriodic acid. He has little or no confidence in any of the local applications, and decries the injection method as seriously prejudicing the chances of recovery if eventually operation should be resorted to. With respect to the use of thyroid extract, Kraske is very outspoken in his objections to the administration, and expressly states that it should be given up entirely for the following reasons: First, the administration of the gland and some of its preparations are not without danger. The author has seen the most alarming cardiac disturbances follow, and in some cases with a fatal issue. Second, the thyroid treatment has absolutely no influence upon retrograde metamorphoses of the gland. If diminution in size of the growth takes place during the administration of thyroid extract it is not the tumor which diminishes in size, but the sound, functioning glandular tissue. Everything else atrophies but the goitre. Third, the thyroid treatment does not facilitate in any way the operation, but it makes it rather the more difficult. The atrophy of the gland and substitution therefor of connective tissue, which makes it more adherent to the surrounding tissue, makes its extirpation or enucleation more difficult.

OPERATIVE MEASURES. There are three operations which have been tried at one time or another, and of these two have been or should be discarded, leaving but one—extirpation of the gland, complete or partial. Ligation of the thyroïdal vessels is a difficult measure, and has met with but a small measure of success; operations upon the cervical sympathetic having been abandoned by such men as Kocher, Kraske, and Riedel. Even if, as Edmunds says, it is believed, for the sake of argument, that the nervous system is the primary seat of the disease, the question then arises as to whether it was the sympathetic or cerebro-spinal system that was at fault; and the very fact that the secretion of the gland can be affected by division of its nerve-supply shows clearly that it (the gland) must have a centre in the medulla. Edmunds' views are wholly in accord with Boissou, who, in 1898, after a critical study of all available cases, concluded that if surgeons had been able by this new operation to modify Graves' disease, the results obtained have no constancy, and are as much confused therapeutically as physiologically—an opinion echoed by Berry in a discussion at the Royal Medical and Chirurgical Society last year. Despite the fact that the evidence is overwhelmingly in favor of thyroidectomy, reports are still coming in from those who persist in the employment of Jaboulay's operation. J. Shelton Horsley¹ points with pride to his case of excision of the right cervical sympathetic, claiming it to be the first time that this operation has been performed for goitre in America. [For the sake of future patients and the reputation of the profession, let us hope it will be the last.] The case is greatly improved, but if improvement does not continue Horsley will try the effect of excision of the left sympathetic. The operation *par excellence* for all cases of goitre, whether associated with Basedow's disease or not, is thyroidectomy; and by thyroidectomy is meant here the extirpation, not the enucleation, of the gland. Enucleation is an eminently suitable method of procedure in cases of benign tumors of the thyroid gland, but in all other instances extirpation, partial—that is, in so far as a small section of the thyroid is allowed to remain—is the operation practised by men best qualified to speak authoritatively. Shield has not seen fit to follow this practice. He enucleates the growth whenever possible; and, furthermore, in cystic cases opens the sac and applies carbolic acid. These practices, together with the administration of a general anæsthetic, have all been abandoned by Continental surgeons.

Technique. Little is to be said of the technique. The operative difficulties and the operative dangers have been described so frequently that there is no excuse for the surgeon of limited experience not being

¹ Annals of Surgery, vol. xxxiii., No. 4.

fully familiar with the steps and complications of the operation. Kocher still holds to his own method of removing the gland as the best,¹ attaching the greatest importance to the use of rigid asepsis in place of antiseptics, and local instead of general anæsthesia. The greatest difficulty will be encountered when the goitre extends into the mediastinum—a condition which has been variously described as *struma occulta* or *intra-thoracica*—and attention is called by Kocher to the frequency with which this condition has been overlooked, in many instances the patients having been treated for asthma on account of the respiratory embarrassment. Mistakes are more apt to be made when the goitre is wholly thoracic, when it should be recognized by the high-grade dyspnoea, due to the displacement of the trachea, by the obstruction and pulsation of the jugular vein, by evidences of paralysis of the recurrent sympathetic, by the presence of an area of dulness over the manubrium and with the aid of the Röntgen ray.

Mortality. The death-rate following thyroidectomy has been very materially reduced. Kocher announces his mortality for all of his operations as 4 per cent., a remarkable showing. Of the 929 benign cases the mortality was $\frac{1}{3}$ per cent., of the 27 malignant cases 22 per cent., of 20 thyroidectomies for strumitus 10 per cent., and of 24 cases of Basedow's disease, 20 per cent. The high mortality in malignant disease is attributed to the necessary interference with neighboring structures, particularly the trachea and œsophagus; the high death-rate in cases of Basedow's disease and strumitis was due to causes for which the operation itself could not be held altogether accountable. Kraske's mortality in his series of 420 cases was $\frac{1}{2}$ per cent., and Riedel's, in his series of 500 cases about the same. (All these operators employ local anæsthesia.) Shield lost but one case in forty-two operations, death having been due to hemorrhage (mortality, 2.4 per cent.). Davis² has collected a series of tables of statistics pertaining to the operative treatment of thyroid tumors during the past fifty years. For the sake of drawing comparisons between the past and the present we will quote some of his figures. In 1850 Kocher placed the mortality at 40 per cent.; in 1883 it fell to 15 per cent., and from that time to 1898 it fell below 3 per cent. These figures were based on Reverdin's collection of 6105 cases, which excluded malignant and exophthalmic cases. In 3408 operations in which there were 118 deaths the mortality of the various operations was as follows: 137 total extirpations, 18.98 per cent.; 1212 partial extirpations, 0.346 per cent.; 1276 enucleations, 0.70 per cent.; 345 resections, 6.66 per cent., and 438 other

¹ Kocher's Operative Surgery, fourth edition.

² Boston Medical and Surgical Journal, vol. lii., No. 26.

methods, 3.88 per cent. It will then be seen that from 1898 to the present time the mortality has been reduced from a fraction below 3 per cent. to a fraction of 1 per cent. It is difficult to see how the mortality can be reduced below this figure.

The surgical treatment of malignant disease of the thyroid gland has not taken part in the great advance made in the treatment of simple goitres. Kocher's mortality in 1883 was 25 per cent., and it is 33 per cent. in his last report in 1898. Thirty-three cases operated in Czerny's clinic gave a mortality of 15 per cent. Five cases were free from recurrence up to four and a half years.

Sarcoma is rarer and more fatal than carcinoma. Tiffany,¹ in 1897, collected 16 cases of sarcoma which were operated on, all with fatal results. Without making special search Davis found 3 more reported cases in the literature and 3 in the records of the Massachusetts General Hospital, all fatal.

In cases of exophthalmic goitre, referring again to Davis' study, Schluz's collection of 319 cases yielded the following results, which included thyroidectomies, ligation of the thyroid arteries, and resection of the cervical sympathetic: Cured, 175 per cent.; improved, 89.28 per cent.; unimproved, 13.4 per cent.; mortality, 13 per cent., the death-rate for thyroidectomies alone being 24.13 per cent., the latter corresponding very closely with the results of individual observers.

In order to complete the series, we quote from the report presented by Jonnesco at the Thirteenth International Congress of 126 bilateral resections of the three ganglia of the cervical sympathetic nerves, and of these 15 were upon patients with exophthalmic goitre, without a fatal result. If with Jonnesco's fifteen we include thirty-five cases of other observers,² the following are the average results: recovery, 11.22 per cent.; improvement, 29.58 per cent.; no improvement, 4 per cent., and mortality 12 per cent., death being due to pneumonia (2), delirium tremens (1), sudden unexplained death (1), after secondary operation (1), and to exhaustion—cachexia (1).

Causes of Death. The causation of the sudden deaths which occur after thyroidectomies has been a matter of some dispute. Edmunds is inclined to believe that the phenomena are to be explained on the assumption that there is a condition of hypothyroidea or athyroidea and not hyperthyroidea. It has been claimed by many that these deaths are due to what may be called thyroid shock, brought about by the absorption into the general circulation of an abnormal amount of thyroid secretion, resulting from the necessary manipulation.

¹ Annals of Surgery, 1897, vol. xxvi. p. 498.

² Bull. et Mém. de la Soc. des Hôp. de Paris, vol. xxiv. p. 893.

Which of these theories is the correct one we are not prepared to say. Mentioned in their order of frequency, the most common causes of death are pneumonia, sudden shock, and collapse and hemorrhage.

ENLARGEMENT OF THE THYMUS.

A child, aged five years, having what was supposed to be an enlarged thymus, was placed by Miot¹ upon 10 cgm. of thyroid extract, and the treatment continued with intermissions for a period of four months, at the end of which time the tumor had disappeared. The swelling appeared very suddenly, and when first seen was about the size of a large cherry and situated at the suprasternal notch; it was of rather firm consistency, not adherent to the skin, but seemingly extending into the anterior mediastinum, and unaffected by deglutition. Reviewing the history given by the parent, and taking into consideration the vascularity of the gland at that age, Miot attributed the sudden increase in size to a hemorrhage into an already congested and vascular gland.

TUBERCULOSIS OF THE PAROTID GLAND.

A case of primary tuberculosis of the parotid gland is reported by Lecène,² and is of interest chiefly on account of its rarity. The clinical diagnosis was a mixed tumor of the parotid, but the histological examination after its enucleation proved it to be a tuberculoma. Secondary tuberculosis of the salivary glands is not such an uncommon affection, as they frequently become affected by contiguity from the overlying lymphatics, but a primary lesion is most exceptional.

TONSILS.

Anomaly of the Tonsil. Richards describes an unusual anomaly of the faucial tonsils in a woman, aged sixty years, who for a long time had complained of pain in the tonsils, radiating to the ears. Upon examination the tonsils were found to be enlarged, and upon attempting to remove them it was found that a portion of the styloid process (?) projected into each tonsil. The condition was more pronounced on the right than on the left side.

The Tonsils as Portals of Infection. Ullman³ has reviewed very carefully the literature bearing on the function of the tonsil and of the

¹ Rev. hebdomadaire de Laryngologie, January 26, 1901.

² Revue de Chirurgie, April 10, 1901.

³ Medical News, vol. lxxviii. No. 4.

rôle it plays as an avenue for infection. It is probable that the normal tonsil has a physiological function of a protective nature, and that infection only occurs through this channel when the tonsil is diseased. Because of its irregularity and of its contour it affords a place of lodgement for bacteria, to which, through air and food, it is constantly exposed. The denudation of epithelium from the surface of the tonsil also removes the only safe barrier, as the mononuclear leucocytes which are formed in the tonsil have very little phagocytic action. Once the organisms have invaded the gland, its rich lymphatic and vascular supply favor their distribution to other parts of the body. There is reason to believe that through this portal of entry many grave and fatal infections occur, as, for example, acute articular rheumatism, endocarditis, scarlet fever, tuberculosis, and possibly those rare cases of typhoid fever in which no intestinal ulcerations can be demonstrated. The similarity of the tonsillar tissues to Peyer's patches suggests to Ullman that the portal of entry of the Eberth bacillus is in the tonsil. He also believes that cases of pyæmia, septicæmia, or septicopyæmia may arise in a similar manner.

Malignant Disease of the Tonsil. The results of tonsillectomies for malignant tumors have never been encouraging. Butlin, in his *Operative Surgery of Malignant Disease*, says that the prospect of permanent relief by operation is small, if indeed there be any. Jacobson,¹ in studying the records of ninety-five cases which he has collected, is disposed to take a less skeptical view, finding that in a series of twenty-four cases in which the growth was removed by an external pharyngotomy not less than four appear to have been radically cured. He furthermore disagrees with Butlin's statement to the effect that removal by external pharyngotomy has not yielded as good results as operations through the mouth, for in each of the four cases reported as cured the external route was adopted, whereas in twenty-nine cases in which the tumor was removed by the mouth only three outlived the two-year limit without recurrence. In operating upon the tonsil for malignant disease, the same rule must be applied as for malignant disease in other parts of the body, viz., that the operation must be radical; and there is no question but that the possibility of carrying out this principle by approaching the tumor through the mouth is very much less. One should not expect to obtain a cure in any case in which there is glandular involvement or when the tumor has invaded the surrounding structures; yet these should not be regarded as contraindications, since, as was pointed out by Cheever, recurrence is more apt to be cervical than faucial, hence much less distressing. To be sure, external pharyn-

¹ *Annals of Surgery*, vol. xxxiii., No. 3.

gotomy is a much more serious and formidable operation, but in the treatment of this so fatal a type of malignant disease this added element of danger is very properly disregarded. Jacobson says that preliminary tracheotomy is more often indicated than not; I should be more inclined to express the indications for this preliminary procedure in stronger terms by saying that, except where there was some distinct contraindications, a tracheotomy should be performed. Although prolonging it, and seemingly adding to the risks of the operation, these apparent disadvantages are more than offset by the advantages which come from being able to administer the anæsthetic without interruption through the tracheotomy tube, and from being able to plug the pharynx and prevent the inspiration of blood or particles of tissue. Jacobson calls attention to the fact that in its early stages sarcoma may resemble a chronic inflammation of the tonsil; as a consequence of this the clinician may be led astray by the pathologist, who may be unable to recognize sarcoma in the tissues removed, as it is usually from the superficial aspect of the growth. If the jaw is divided Jacobson prefers to hold the divided ends in apposition by the intradental splint rather than by wiring, as it permits free movement of the bone and immediate use of the jaw for mastication.

Abscess. The surgeon is occasionally called on to lance peritonsillar abscesses, and should acquaint himself with the best site for his incision and with the dangers that are attendant upon this minor surgical procedure. The infections arise in the cellular tissue above, behind, or in front of the tonsil, or in the pharyngomaxillary space. This space is divided into two compartments by the stylopharyngeus muscle and its fascia, so that, according to Chiari, when the abscess develops spontaneous evacuation tends to take place in a forward and inward direction, owing to the resistance offered behind. The abscess tends to point between the pillars either in front of or behind the tonsil, so that the incision should be made in either the anterior or posterior pillar, in which place fluctuation or bulging may be detected. If there is no evidence of abscess in either pillar the pus will probably be found in the supratonsillar fossa, and the incision for an abscess in this situation must be made with great care, owing to the proximity of the great vessels, which really occupy the pharyngomaxillary space. Free incisions for the relief of peritonsillar abscesses are not required ordinarily; but in some instances, particularly in the anterior pillar, there is a tendency for the wound to close, and if the symptoms recur, as they often will within a few hours if the opening is not free enough, it will be necessary to repeat the operation.

PHARYNX.

Cicatricial Stricture of the Pharynx. B. Farquhar Curtis¹ describes a plastic operation which he performed on a case of intractable stricture of the pharynx. The tendency to recurrence was such that an operation became necessary as a life-saving measure. A tracheotomy was performed under chloroform anæsthesia, and with the head in Rose's position a transverse incision was made above the hyoid bone, laying open the pharynx in the left side between the epiglottis and the tongue. The lower pharynx was found to be shut off from the upper by a membranous septum extending from the posterior pillar of the fauces and left side of the pharynx across to the base of the tongue. The edge of the membrane was divided through the mouth until a finger could be forced through, and the opening further dilated until it admitted of three fingers. This left a defect on the left side of the pharynx extending from the glosso-epiglottic fold to the level of the hard palate, and from the tonsil to the posterior wall of the pharynx. A flap two inches broad and five long, consisting of skin and subcutaneous tissue, was fashioned, with its base at the angle of the jaw and its apex directed downward, its anterior margin corresponding to the incision made into the pharynx. This flap was reflected and secured in place so that its raw surface lay in contact with the defect to be repaired. The upper pharynx was packed with gauze, in order to keep the raw surfaces in good apposition. On the twenty-fourth day the opening in the pharynx was closed, and a few days later the tracheotomy-tube was removed. The patient was nourished by rectal feeding for the first week and for a period of four days after the second operation. Although the patient has made little use of the bougie since her discharge from the hospital, there has been very little recontraction. The transplanted skin has assumed the appearance of mucous membrane. She swallows well, and respiration, which before the operation was so stridulous as to be heard across a large room when she was at rest, is now only noisy on exertion. Her general health is very much improved.

Pharyngeal Pouch. An interesting case of this sort has been reported by Bucknell.² His patient was some thirty years of age, and had had for the past three years repeated attacks of dysphagia. The pouch, which extended from the median line of the neck to the posterior border of the sternocleidomastoid and from the jaw to the clavicle, was removed with considerable difficulty. It had a narrow pedicle, which passed through the thyrohyoid membrane, but there was appar-

¹ *Annals of Surgery*, vol. xxxiii., No. 2.

² *Lancet*, May 18, 1901.

ently no communication with the pharynx. Usually the internal opening of these congenital tracts is to be found close to the margin of the tonsil in the pharynx, and not, as other observers have pointed out, in the larynx.

ŒSOPHAGUS.

Exploration of the Œsophagus. The instrument best adapted for the exploration of the œsophagus corresponds to the bougie à boule of the urethral armamentarium, having a flexible shaft of hard rubber and solid hard rubber acorn tips. In strictures of small calibre, and therefore difficult of penetration, Henle¹ has had some experience with what he terms the method of Socin, in which the patient swallows a thread to which fine shot is attached. Should the patient swallow both ball and thread it may be difficult to find and extract the ball; in order to overcome this difficulty Henle suggests the following plan, which he has always found successful. He substitutes for the lead a steel ball. If this is lost in the stomach he passes through a gastric fistula an instrument somewhat similar to a steel sound, which is charged with electricity and acts in the capacity of an electro-magnet. The ball, lying free in the stomach, will be attracted to the instrument, and through its magnetic influence remain in contact with it while being withdrawn from the stomach. König is usually accredited with the introduction of this plan of treating strictures of the œsophagus impermeable to bougies. He used perforated silver balls of graduated sizes, and dilated the stricture up to a calibre which would admit of the passage of a bougie. The suggestion of Henle necessitates the performance of a gastrostomy, with the establishment of a gastric fistula—a procedure which should be reserved for strictures absolutely impermeable to those devices introduced through the mouth. On the whole, Henle's plan does not meet with our unqualified approval.

An analogy between the exploration of the œsophagus and that of the urethra can be drawn in many particulars. Stark,² recognizing this, has employed a flexible sound resembling in its construction a Mercier or elbowed catheter. The tip of the sound, which is from $\frac{1}{2}$ to 3 cm. in length, forms an obtuse angle with the shaft. Just as we find it advantageous to use a filiform bougie with an angular tip in attempting to pass the instrument through an urethral stricture of small calibre, so Stark has found it advantageous to use an instrument constructed on the same principle in small-calibre strictures of the œsophagus.

¹ Centralblatt f. Chirurgie, 1901, No. 34.

² Münchener med. Wochenschrift, 1900, No. 49.

Spivak¹ devised an instrument for determining the precise length of the œsophagus, which consists essentially of a stomach-tube provided at its distant end with a whistle, hence called the œsophagometer or intragastric whistle. The whistle is so placed that while the stomach-tube traverses the œsophagus the sounds are smothered; but once the cardia is reached a distinct whistle is heard.

THE ŒSOPHAGOSCOPE is the most recent addition to the surgeon's armamentarium for the diagnosis and localization of lesions of the œsophagus. In the Breslau clinic, Gottstein² has employed this instrument some forty-seven times in thirty-four cases, with gratifying results; in thirty-two of these he was able to establish a diagnosis of carcinoma, in one of peptic ulcer, and in another of actinomyces. The diagnosis is based upon the examination of a section of tissue excised from the affected area with the aid of the œsophagoscope. In his experience it is a procedure which has been found free of danger, has given rise to no subjective disturbances, and but little hemorrhage. This minor operation is not difficult of execution; in fact, it is oftener much easier than that upon the larynx. Occasionally the patients experience temporary relief by the removal of fragments of the tumor and the re-establishing of the passage into the stomach.

Gottstein³ employed this instrument also in the localization of strictures, failing to penetrate the stricture in but six out of one hundred cases.

Removal of Foreign Bodies from the Œsophagus. W. J. Taylor succeeded in removing from a child, aged sixteen months, a metal clasp which had been in the gullet seven months. The foreign body was removed by an external œsophagotomy; convalescence was uneventful, the wound in the œsophagus having closed gradually by granulation. No fluids passed out of the wound after the twentieth day. The case was interesting because of the age of the child, the length of time the foreign body had remained lodged in the gullet, and the speedy recovery from an operation of such gravity. In speaking of the management of cases of foreign bodies in the œsophagus, Taylor firmly believes that no attempt should be made to remove foreign bodies by the mouth except they be perfectly smooth and in position no longer than twenty-four hours, or possibly forty-eight hours. Œsophagotomy is not a difficult operation, and by its performance the foreign body can be removed with a minimum amount of damage to the tissues; the shock and loss of blood are very slight and the chances of complete recovery excellent. A short and fatty neck should not be given too much consideration in

¹ New York Medical Journal, August 31, 1901.

² Beiträge zum Centralblatt für Chirurgie, 1901, No. 29.

³ Mittheilungen aus d. Grenzgebieten d. Medicin u. Chirurgie, Bd. vi., Heft 4 u. 5.

our selection of a method of reaching the foreign body. Its precise situation should be previously determined by the skiagraph, and in every instance the skiagraph should be taken with the child fully anæsthetized, otherwise it will be difficult or almost impossible to keep the child quiet enough to obtain a satisfactory picture. An attempt should always be made to close the œsophageal wound with sutures, for even if we are not fortunate enough to secure union by first intention we should succeed in diminishing the length of the wound.

Hacker¹ and Wilms² have both preferred the use of the œsophagoscope to an œsophagotomy for the removal of foreign bodies. The former's experience with this method includes some twenty-seven cases, in all of which save one he was successful in localizing and removing the object without injury to the patient. He first uses a sound tipped with metal or ivory to detect the presence of the foreign body, and then proceeds with the œsophagoscope to effect its removal. This instrument should prove a useful adjunct to the œsophageal forceps, but there are some instances in which the open operation would be the safer mode of procedure. I refer particularly to those cases in which the object has been lodged in the œsophagus some time and caused such ulceration of its walls that the slightest manipulation may be followed by perforation and infection of the peri-œsophageal tissues.

Periœsophageal and Mediastinal Abscesses. These are to be numbered among the possible complications of ulceration of the wall of the œsophagus from whatever cause. When the tissues about the tube become contaminated by its infectious contents the inflammatory process may advance rapidly and soon give rise to symptoms so threatening in character as to demand early operative intervention. When the abscess is limited to the cervical portion of the œsophagus it is best evacuated by an incision along the anterior border of the sternocleidomastoid; but when situated in the mediastinum it can be approached in one of two ways, either through the neck—cervical mediastinotomy—or through the back—dorsal mediastinotomy. Von Hacker,³ who has gone into the subject quite exhaustively, has concluded that the cervical route is, if nothing else, the safer of the two. In approaching the abscess through the back it is always difficult to avoid opening and infecting the pleural cavity, and this constitutes the chief objection to this route. In the majority of instances the infection begins at the cervical portion of the œsophagus, in which case the question of the best method of approach would not come up for discussion; but even if the inflammation does begin in the mediastinum, it will

¹ Beiträge z. klin. Chirurgie, December, 1900.

² Deutsche Zeitschrift für Chirurgie, Bd. lx., Heft 3 und 4.

³ Archiv f. klin. Chirurgie, Bd. lxiv., Heft 2.

very soon extend to the neck. If dorsal mediastinotomy, as advocated by Ziemicki, is to be given any place in the treatment of mediastinal abscess it should be held in reserve, to be performed as a secondary operation in the event of the other failing to effect a cure and to afford absolute relief. In some instances the performance of a cervical mediastinotomy will serve, according to v. Hacker, to allay the threatening symptoms by partially emptying the abscess, and thus relieving the tension and consequent pressure.

The patient will now react from the effects of septic intoxication and pressure, and will be in a much better condition to stand the severer operation (dorsal mediastinotomy), should this subsequently prove necessary, either because of a recurrence of the previous condition or because more thorough drainage was necessary to bring about resolution.

In some cases it is of advantage to know whether or not the perforation in the œsophagus has closed. This information may be derived in the following way: A strip of gauze, saturated with a 2 per cent. solution of ferrocyanide of potassium, is introduced with a sound to the depth of the abscess. The patient then swallows a 2 per cent. solution of ferrum citricum oxydatum, and if any communication between the œsophagus and abscess cavity still exist the strand of gauze will be stained a deep blue. This test may be repeated from time to time during the convalescence until the œsophageal opening is finally closed.

If it becomes necessary to open a mediastinal abscess from behind the surgeon will find it to his advantage to know its boundaries, in order that he may establish the drainage opening at the most dependent point, and in order that he may know whether it is more easily approached on the left or on the right side. v. Hacker in one of his own cases was desirous of acquiring this information for these very reasons, and he did so in the following way: After introducing a rubber drainage-tube into the cavity a skiagraph was taken. Knowing the diameter of the drainage-tube and comparing it with the diameter of its shadow upon the skiagraphic plate, he was able to estimate the distance of the end of the tube from the plate, which in his case was 9.7 cm. He found that the distance from the anterior aspect of the vertebral bodies to the plane on which they were lying was in a number of cadavers which he examined on an average 10 cm., and concluded that in his own case the end of the drainage-tube, which the skiagraph showed to be on a level of the fifth rib, must be almost in contact with the vertebral column. Thus he was able to determine how deep he must penetrate the tissues from the back before entering the abscess cavity. The boundary lines of the abscess were determined by filling the cavity with iodoform glycerin before the skiagraph was taken. In his own case he discovered by this simple procedure

that it could be approached as easily from the right as from the left side of the spinal column, and since the position of the aorta makes the approach from the left side more dangerous and difficult, this bit of information was most acceptable.

Diverticula of the Œsophagus. Starck has written a monograph of some 206 pages based upon careful perusal of the literature and his own personal observation. In speaking of the distinction between the two general groups, namely, the traction and pressure diverticula, the presence or absence of the muscular coat of the Œsophagus does not constitute the chief distinction. As to the etiology of the traction diverticulum, the primary cause is usually inflammation of the glands at the level of the tracheal bifurcation. The glands may be alone affected, or there may be associated therewith some disease of the lungs, particularly tuberculosis and pneumonic processes. Inflammations of the pericardium and pleura seem to play some rôle in the etiology of this affection; it is doubtful, however, whether they are in any instance of congenital origin. There are many features which are still difficult of explanation, chief among which is the absence of any symptoms which make a diagnosis possible; yet in spite of the absence of symptoms these diverticula often threaten life, perforation occurs, and the escaped contents of the diverticulum lead to infection of the mediastinum and pleural cavity, to aspiration pneumonia, gangrene of the lung, and pyopneumothorax. Furthermore, these diverticula appear to predispose toward the formation of carcinoma. In the case of the pressure diverticula the diagnosis may be established by the change which takes place in the size of the cervical swelling on the ingestion of food or by the use of the Œsophagoscope and Œsophageal sounds in connection with the rather characteristic history that is usually given. Owing to their essentially chronic and progressive course, the prognosis is always grave. Death results either from starvation or from some intercurrent disease, most commonly aspiration pneumonia. When the patient is greatly emaciated and debilitated, gastrostomy, with the establishment of a temporary fistula, is the operation of choice. Should the patient's condition permit, and should there be no contraindications, extirpation of the diverticulum should be regarded as the only radical method of treatment. When the diverticula are very small the invagination method, as suggested by Girard, may be substituted for extirpation. Veiel¹ has studied rather carefully a series of twenty-two cases of extirpation of these diverticula, and noted that in only three did the Œsophageal wound close by first intention. He believes the failure to obtain primary union is due to the want of care in the application of the sutures and to the hastiness with

¹ Beiträge z. klin. Chirurgie, Bd. xxvii., Heft 3.

which food is administered by the mouth. Out of the twenty-two cases of this series there were five deaths, and though the mortality is high (25 per cent.) it should not constitute any contraindication to operation, since the eventual fate would be either starvation or carcinomatous degeneration of the affected tissues. There are certain methods other than operative which have been applied, it is claimed, with some degree of success. In one the patient is instructed to lie on the side opposite to the diverticulum, so that the food will gravitate from the diverticulum, and if the treatment is persisted in sufficiently long atrophy of the sac may ensue. Another method is the application of faradism to the sac, and a third the repeated use of the sound with the hope of preventing stenosis of the œsophagus.

LARYNX.

Exposure of the Vestibule of the Larynx and Lower Portion of the Pharynx. Vallas¹ has suggested a rather novel way of exposing the larynx and pharynx for the removal of foreign bodies, benign neoplasms, epiglottic and lingual cancers, as well as for the treatment of strictures. It consists essentially in a median osteotomy of the hyoid bone, and is carried out in the following way: A vertical incision is made from the symphysis menti to the superior angle of the thyroid cartilage. After separating to the median line the fibres of the mylohyoid muscle, the hyoid bone is divided. In order to expose the lower part of the pharynx it is necessary only to divide the thyrohyoid membrane; the upper portion of the pharynx and tongue is separated from the wound only by the buccal mucous membrane. He has been able through this route to practice excision of the tongue. The buccal attachments of the tongue (including the anterior pillars of the fauces) are divided by an assistant through the mouth. There remains nothing but the attachments of the hyoglossus to divide. To carry out this step the patient is put in the sitting position, with the head inclined forward, the tongue is delivered through the submental wound, and the attachments of the hyoglossus muscle to the hyoid bone divided with a pair of scissors. This operation of Vallas, it seems to me, as applied to excision of the tongue has no advantage over Kocher's method, in which the tongue is removed through the floor of the mouth after a preliminary tracheotomy. Kocher's incision is better adapted to exposure of the region of the lymphatic glands, and renders the field of operation most accessible to the surgeon. I should rather restrict the indications for median osteotomy of the hyoid bone to operations for

¹ Revue de Chirurgie, May, 1900.

lesions in the immediate neighborhood of the hyoid, among which Vallas has included the removal of foreign bodies, benign and malignant neoplasms of the epiglottis, and the division of strictures.

"Intubation Trauma." Every surgeon is more or less familiar with the technique of intubation and with some of the difficulties attending the introduction of the tube, but few have given any serious consideration to the injurious effects, either temporary or permanent, upon the tissues exerted by the tube upon its introduction, while *in situ*, or upon its removal. Bokay¹ has devoted a great deal of time and thought to the study of these lesions. Slight erosions of the mucous membrane sometimes follow the introduction of the tube, which undergo repair and give rise to no permanent disturbances. Such an accident as perforation, which has occasionally happened, should be charged against the inexperience of the operator. The lesions most serious in their consequences are the decubital ulcers which develop while the tube is *in situ*. Basing his observations upon a collection of 1203 cases of intubation, of which number 360 came to autopsy, Bokay found that in 156 of these, or 13 per cent. of the entire series, decubital ulcers were present; of 499 cases which recovered 16 gave evidence of deep ulceration. Excluding from the autopsy series those ulcers which were quite superficial, the percentage would be reduced by at least 5 per cent. The seat of the ulcer was almost uniform throughout; most frequently upon the anterior wall, involving the larynx itself, the thyroid, and the cricoid cartilage in this order of frequency. The degree of ulceration varied from one most superficial in type to one extending to and in some instances through the cartilage. Certain factors seemed to play a part in the etiology, chief among which was the material of which the tube was constructed, the others being the age and individual disposition of the patient and the length of time the tube was in place. According to Bokay, hard rubber inflicts the least damage.

As to the symptomatology, a slight or superficial ulcer gives rise to no exceptional or particular phenomena; the deeper lesions can be recognized by coughing, by the expectoration, which sometimes is bloody and sometimes contains black flakes from the plating of the tube. Perhaps the most significant symptom is the difficulty in breathing, a condition which has sometimes required a secondary tracheotomy. In the author's opinion, secondary tracheotomy should be reserved for those cases in which there is positive evidence of deep ulceration. He has found that the substitution of a shorter or thinner tube, or one medicated with an astringent, will often suffice to afford relief. In some instances the lesion is quite protracted, and responds little if any to

¹ Deutsche Zeitschrift f. Chirurgie, Bd. lviii.

palliative remedies, to anything short of a tracheotomy. Of the eight cases which the author was called upon to treat three died of catarrhal laryngitis and two were cured by tubage.

Stenosis of the Larynx. Alapy¹ reports what he asserts to be the first case on record of a complete cure of an impermeable stenosis of the larynx by excision of the cicatricial tissue and closure of the defect with a Thiersch flap. The idea did not originate with Alapy, but was first successful in his hands. The cicatricial tissue was dissected out, leaving a circular defect which exposed the first ring of the trachea and the cricoid cartilage. A Thiersch flap was transplanted from the thigh to the larynx and secured in place by a plug of gauze. When the gauze was removed, on the eighth day, the flap was found to have become united to the underlying tissue. At the expiration of nine months the fistula had closed; the voice, though harsh, was strong and distinct. The usual methods of treating cicatricial stenosis of the larynx, such as repeated intubation, tracheotomy, and dilatation, had been previously tried, without success.

Extirpation of the Larynx. Davis,² in his discussion of the technique of this operation, considers those points which are still unsettled. As shock, hemorrhage, and aspiration pneumonia are the most common causes of death, any improvement in the technique must be directed toward the prevention of one of these complications. According to Butlin, collapse and paralysis of the heart are frequent causes of death, conditions against which there are no sure means of guarding. The ill effects of hemorrhage may be avoided by careful hæmostasis. Aspiration pneumonia is less likely to develop under local than under general anæsthesia, and for this reason local anæsthesia is to be preferred, despite the fact that it prolongs the operation. According to Davis, the most important undecided point is as to the desirability of a preliminary tracheotomy. On this point authors differ. Delavan states that nearly all authors agree that a preliminary tracheotomy is necessary. Butlin says that tracheotomy is performed either at the time of the extirpation or some time previously, according to the patient and views of the operator. Watson Cheyne advocates tracheotomy at the time of the major operation; Keen believes it better to omit tracheotomy altogether. Delavan favors preliminary tracheotomy because the use of a tube is irritative, and a few days will allow the irritation to subside. Furthermore, some time is saved in performing the operation, shock and hemorrhage are less, and the administration of the anæsthetic easier.

¹ Centralblatt f. Chirurgie, December 29, 1900.

² Annals of Surgery, vol. xxxiii., No. 1.

Of considerable importance is the adoption of some method to prevent the tugging upon the wound that will take place with every inspiration. This is best accomplished by fixing the trachea firmly in place before the major operation is performed. Davis lays great stress upon the advisability of taking this precaution, and regretted not having performed a preliminary tracheotomy and fixed the trachea to the wound in his own case, in which the unfavorable issue was largely due to the tearing out of the stitches and the consequent infection.

Whenever the patient coughed the trachea jumped up and down, pulling violently on its attachment to the skin, so that by the third day some of the stitches had cut through and were removed. Had a preliminary tracheotomy been performed the trachea would have been fixed in place, and there would have been no ulcerating wound constantly irritated by the tugging of the trachea on the skin. The wound from the divided trachea up to the hyoid bone had healed by primary union, but just on the surface posterior to the upper edge of the divided trachea there were a few drops of pus; there was no pus between the posterior surface of the trachea and the œsophagus. The edge of the wound around the trachea was inflamed, and it must have been here that the infection started in spite of the efforts made to prevent it. The patient upon whom Davis operated was forty-six years of age, and had a carcinoma of the larynx. The operation was performed under eucaine anæsthesia, although it had been the intention of the operator to administer chloroform as soon as the trachea had been opened; but the operation progressed so satisfactorily under local anæsthesia that the latter was continued. On the fifth day after the operation the patient suddenly became wildly delirious and jumped out of bed; after this he became unconscious, his heart action weak, hyperpyrexia developed, with œdema of the lungs, and death soon followed. Post-mortem examination proved that death was due to general streptococcic infection. One of the interesting features of the case was the fact that soon after the operation the patient could talk in a low whisper sufficiently clear to make himself easily understood. Davis sums up his views on the points of the technique which are at issue in the following words:

"It is feasible to remove the larynx under eucaine anæsthesia. If the two operations are done simultaneously, and a favorable course is pursued, the result will be brilliant, the patient being 'out of bed on the fourth day.' It is my belief that Delavan is right, and that preliminary tracheotomy ought to be done. We should not sacrifice safety for brilliancy; that the leaving of an œsophageal-tube projecting from the wound is probably unnecessary, the patient swallowing on the third day. The wound need not be tamponed, but can be closed from the

upper edge of the trachea to the hyoid bone. These patients can make their wishes understood by speaking in a short time after the complete removal of the larynx. In this case it was found comparatively easy to remove the larynx from below upward, going up one side, then across at the hyoid bone, and down the other."

Hippel¹ relates his experience with Foederl's method of extirpation of the larynx, and concludes that in the future he would not carry it out except with certain modifications, since in its present form the dangers are much greater than its advantages. The operation might be carried out in two stages—at the first sitting following the method of Glück-Zeller; and later, if the pharyngeal wound has firmly united and the patient's condition warrants it, dissecting the trachea free from the skin and anchoring it to the freshened epiglottis and hyoid bone. In Hippel's case the sutures tore out, the wound became infected, and the stump gangrenous, and had it not been for the greatest vigilance the patient's life would have been lost. The ultimate results were, however, good. A year after the operation the patient could speak in a whisper, was in excellent health, and had no signs of recurrence. The tumor was a round-celled sarcoma, which, according to the classification of Bergeat, occupies a position as to its malignancy about midway between the comparatively benign spindle-celled and the very malignant alveolar sarcoma.

The mortality of laryngectomy has been reduced from 40 per cent. or thereabouts to about 10 per cent. Hippel, in commenting upon this material reduction, calls attention to the factors which alone made this possible. First and foremost must be mentioned the introduction of antisepsis and asepsis, not only because infection of the wound plays a most important rôle in the immediate results, in that it is responsible for many deaths from septic pneumonia, but because in this operation the wound is subjected to contamination, not only during its performance, but constantly during the convalescence until union has occurred. Kocher deserves first mention among those who have contributed to the success of the operation by substituting local for general anæsthesia. The third factor that has contributed toward a reduction of the mortality was the division of the operation into two stages. The last step in its development was suggested by Foederl, who re-established the continuity of the air-passages by anchoring the stump to the hyoid bone. Foederl carried his method out in one sitting; but, as has already been pointed out, Hippel regards this as a dangerous proceeding, and postpones this last step until union of the pharyngeal wound has occurred.

¹ Archiv. f. klin. Chirurgie, Bd. lxii., No. 1.

OSSEOUS STYLOHYOID ARCH.

The stylohyoid arch in the adult comprises the styloid process of the temporal, the stylohyoid ligament, and the lesser cornu of the hyoid bone. Except for difference in shape and comparative size, it is practically a constant structure in the higher vertebrates; there is, however, much difference in the extent of ossification. In the lower animals—as in the horse, cow, and sheep—it is completely bony, and in man it is not unusual to find one of the stylohyoid ligaments represented by osseous tissue. “It is, however, comparatively rare to find a complete symmetrical bony arch, and rarer still to find cases where the four primary divisions of the cartilaginous hyoid bars exist as separate and distinguishable elements, though this is sometimes seen, as in a specimen presented to the Anatomical Society of Paris, in August, 1900, by Sebilleau and Gibert.” Crowder,¹ referring to the development of this hyoid bone and its arches, thus describes three of these osseous stylohyoid arches, two of which were recently found in the post-mortem room of the Cook County Hospital, the third belonging to the collection in the museum of the Rush Medical College:

“In none of the cases was the condition noted before death, nor did it give rise, so far as is known, to any recognizable difficulty. Of one of these cases I am able to present only the fact of its observation, the specimen having been mislaid or destroyed. It concerned a complete bony arch, with fibrous articulation of the hyoid ends. I am not able to say that each of the four divisions was present as a separate articulated piece on either side, only that there was no considerable portion of ligamentous tissue. The arch of the second case was roughly removed, and hence mutilated by fracture. It articulated with the temporal at the normal location of the styloid process, with slight or no mobility. In the specimen presented there remains the greater part of the epibranchial—a straight, roughly cylindrical bone about five centimetres in length, which represents the normal stylohyoid ligament. The ceratobranchial is also osseous, and something less than a centimetre in length. It articulates loosely by fibrous tissue with the epibranchial above, and below with the diminutive hypobranchial or lesser cornu of the hyoid; or possibly this small division represents the epibranchial and hypobranchial fused together, hence the whole of the lesser cornu, the fibrous union being directly with the body of the hyoid at the normal location of its lesser cornu. The third specimen has been preserved entire, including a part of the temporal on either side. In this case the separate parts are plainly made out. On the

¹ *Medicine*, May, 1901.

right side the dorsal segment (pharyngobranchial or styloid process) arises from the base of the temporal, behind and internal to the vaginal process, as a bony projection 1.5 cm. in length, the union being osseous and immovable. It is parallel for half its length by the flattened and elongated vaginal process, and with this it is firmly fused. On the left side the first segment is 2 cm. long, and articulates laterally with the vaginal process of the temporal by close, though slightly immovable fibrous union. These upper segments articulate end to end by fibrous union with the second segments (epibranchial or stylohyoid ligaments). There is only very slight motion at this joint. The second segment measures 6 and 5 cm. in length on the right and left sides, respectively. The remaining segments are as in the preceding case, the fused ceratobranchials and hypobranchials (representing the lesser cornu of the hyoid) measuring 0.75 and 1 cm. on the right and left sides, respectively. The union at either end of these bones is a loose, fibrous hinge. The hyoid bone presents no gross abnormality of form or position in either of the cases.

"This anomaly is to be considered one of development only. It has its origin in the embryonic tendency of cartilage to ossify, and is not an ossification of the stylohyoid arch once developed in the usual way. It is a reversion to a lower type. So far as I know, it is interesting from the anatomical stand-point only, and has no clinical importance beyond the possibility of fracture and its complications. The bones being situated deeply in the tissues of the neck, and so high up as to be much protected by the lower jaw, render this accident improbable."

WOODY PHLEGMON OF THE NECK.

Two of these rather rare lesions have been reported during the past year. Emerson's case¹ illustrated that peculiar suppurative process, described by Brousses and Brault, in which the inflammation is confined to the glossothyro-epiglottidean cavity. The neck was uniformly swollen down to the clavicle; the swelling was firm to the touch, of woody consistency, and divided by septa into three lobes. Dysphagia and dyspnoea were both marked. The treatment consisted in the application of ice-poultices alternating with an ointment of resorcin and lanolin, one drachm to the ounce, together with the use of a steam atomizer. Spontaneous evacuation of the inflammatory product occurred, and convalescence, though slow, was uninterrupted. The second case developed during convalescence from bronchopneumonia in a man aged thirty-five years. Bacteriological examination failed to detect any

¹ Boston Medical and Surgical Journal, November 25, 1901.

bacteria such as have been found in other cases. Although the condition was not alarming, it was most persistent, and it was not until some months had elapsed that the fistula finally closed.

SURGERY OF THE CERVICAL SYMPATHETIC.

Sympathectomy is by some regarded as an established procedure in the treatment of certain affections, mostly of neuropathic origin, chief among which are glaucoma, Graves' disease, and epilepsy. Jonnesco recommended this operation for epilepsy with the hopes of converting a cerebral anæmia, which he believed was the cause of the disease, into a cerebral hyperæmia. Jaboulay introduced this treatment for Graves' disease on the ground that the cervical sympathetic, through its influence upon the secretion of the thyroid, was directly or indirectly responsible for the nervous manifestations. Abadie, on the ground that the lesion was due to vasoconstriction, was the first to advise resection of the superior ganglion for glaucoma. Chipault and Kulmus have each reported a successful result with sympathectomy in the treatment of spasmodic torticollis. Quite recently trifacial neuralgia has been included among the indications for its performance. Delagénère¹ reports his unfavorable experience in two obstinate cases. He not only resected the cervical sympathetic, but resected and forcibly stretched the peripheral branches. In one case the amelioration was only temporary, in the other the patient experienced no relief whatsoever. The experience of Cavazzani with this operation was more encouraging; in his two cases there had been no recurrence for periods of four and seventeen months, respectively. Cavazzani attributes the relief to some alteration or perversion of the trophic influence exerted by the sympathetic upon the Gasserian ganglion. Jonnesco,² it is alleged, has reported three successful cases.

THORACIC DUCT.

The idea was at one time prevalent that wounds of the thoracic duct were not only always grave, but often fatal; and even to-day the surgical profession has rather an erroneous impression of the significance of these injuries. When death occurs either the injury has not been recognized or the duct has been wounded in the thorax, where even had it been recognized the wound could not be closed by surgical inter-

¹ *Travaux de Neurologie Chirurgicale*, June, 1901.

² *Williams. Medical News*, April 6, 1901.

vention. Allen and Briggs¹ have collected all the cases which they have been able to find recorded in literature—fifteen in all—to which they add two which happened in their own experience, one during an operation for the removal of tuberculous glands, the other for the removal of a metastatic growth in the subclavicular glands. It is interesting to note that in only three cases was there any constitutional effect evident, that there was but one death, and that bearing no apparent relation to the injury of the duct. The failure to recognize these injuries at the time of operation is due to the fact that the fluid which is circulating in the duct, when the patient has been prepared for operation by fasting, resembles serum. Only in those cases in which, within a short time prior to the operation, the patient has eaten some fat-containing food will there be found any chyle in circulation. This physiological phenomenon suggested to Allen the advisability, in those cases in which there was danger of wounding the thoracic duct, of administering four to six ounces of cream three hours before operation; this would ensure the free circulation of chyle during the operation and render a wound of the duct easy of detection. This plan would be especially desirable in secondary operations undertaken for the purpose of locating the point of injury. As to the immediate treatment, the wound should be closed preferably by sutures, or, if this be impossible, by packing. The head and neck should be kept at rest, and morphine administered as freely as may be necessary to control restlessness. Attention to the diet should constitute an important feature of the after-treatment until the wound has undergone repair. To reduce to a minimum the tension in the wall of the duct all fats should be excluded from the diet and nutrition sustained upon albuminous material, with possibly a small amount of carbohydrates. Properly prepared beef juice and egg albumin, centrifugalized milk, oysters, fish, and raw vegetables constitute a very suitable diet.

HEART AND LARGE VESSELS.

Wounds of the Heart. The history of this branch of surgery has been a series of successive triumphs. The reports that are coming in from all sides serve to assure us that we will not have to retrace the steps taken in this new and but recently explored field, and encourage us to stand firmly on our vantage ground. As Vaughn puts it, the time has arrived when a wound of the heart should be operated upon with as little hesitation as a wound of the brain, with the expectation, under corresponding conditions, of getting equally good results. The

¹ American Medicine, September 21, 1901.

mortality must inevitably be high—not from the operation, but from the injury itself, especially if all cases, including desperate ones, be undertaken. Selection of cases in which the patient has survived five or more hours after receiving the wound would give a good percentage of recoveries, but such a selection is not to be recommended.

The present status of this branch of surgery is well presented by Nietert,¹ who has been able to collect some twenty-three cases of penetrating wounds of the heart which were exposed and sutured. Included in these is a case which came under his own observation. The patient received a stab wound in the fifth intercostal space, at the right margin of the sternum. He was first seen two hours afterward, and after a hurried examination immediate operation was decided upon. As the patient was at the time unconscious, no anæsthetic was necessary. A semi-circular incision was made over the sternum, and a flap with its base toward the left side reflected. The recommendation of Giordano was carried out, and the canal of the wound followed up to the pericardium and heart before an osteoplastic flap was resected. The cartilages on the fifth and sixth ribs were divided near the sternum, and a sufficient portion of the sternum removed with rongeur forceps to expose the pericardial wound. The wound in the heart could be felt easily by the examining finger, and in order to make the wound easier of approach the opening in the sternum was enlarged to a diameter of two inches. After enlarging the wound in the pericardium and grasping its edges the clots were removed, and an appreciable improvement in the force of the heart-beat was at once noticed. The wound of the heart, which was an oblique one into the right ventricle, about half an inch long, was closed with interrupted silk sutures. While this step of the operation was being carried out the patient regained consciousness and conversed in a perfectly rational manner, and stated that he felt no pain. He reacted nicely, but died thirty-three hours after the operation, apparently from suppression of urine. At the autopsy the pericardial sac was found to be completely obliterated and the heart entirely covered with a fibrinous exudate. The case presented some features of more than usual interest. The restoration of consciousness, once pressure upon the heart was removed, made it appear as though the unconscious state were due not to shock or loss of blood, but to the circulatory disturbance. Secondly, it was the first case operated upon in which no injury had been inflicted upon the pleura. In all but one of the other twenty-two cases the wound was on the left side. The escape of the pleura accounted for the absence of many symptoms which have been observed in other cases. Thus, there was an absence of the splashing

¹ Philadelphia Medical Journal, December 14, 1901.

sounds usually heard over the pericardium in injuries of this kind. According to Nietert, this sound was not heard in his case, because of the increased intrapericardial pressure, there being no communication or avenue of escape into the pleural cavity, and, as Nietert very rightly says, this should constitute an important diagnostic sign in differentiating between wounds of the pericardium which do or do not communicate with the pleura. The whizzing sound indicative of the presence of air in the pericardium was also absent. Another interesting feature of this case was the direction and seat of the wound, both of which were such as to permit of the least hemorrhage, and were chiefly operative in preventing the patient from rapidly bleeding to death. As Elsberg in his exhaustive and authoritative work pointed out, oblique wounds bleed far less than perpendicular ones, since the systolic contraction of the heart tends to tightly approximate its edges. The wound was situated in Nietert's case between two columnæ carnæ, so that during systole the columnæ were pressed together, and in this way closed the wound.

OPERATIVE TREATMENT. In the operative treatment of punctured wounds of the heart one should not be governed by any hard-and-fast rules, but must be largely influenced by the conditions present in the individual case. Two methods have been devised for suturing the heart—one the extrapleural, as described and advocated by Rydygier and Giordano, the other the intrapleural. Inasmuch as, with but two exceptions, the external wound has been upon the left side of the sternum, and the pleural cavity involved in all but one case, it will be readily seen that the intrapleural method would be the one applicable to the larger majority of cases. Rotter's operation, which in Nietert's opinion is the best of the intrapleural methods, is carried out as follows: It consists of an incision extending from the left border of the sternum, parallel to the third rib, outward about two inches. A second incision is made on a level with the sixth rib, and extending from the left border of the sternum to a point two inches toward the left side. A third incision connects the outer ends of the two incisions. The third, fourth, and fifth ribs are then divided in the line of incision, as are also the muscles and pleura. The entire flap is then forcibly turned toward the right side and the cartilages broken near the sternum. In this way the right ventricle and a large portion of the left can be brought clearly into view. The hand can readily be passed into the chest cavity and the heart grasped or pressed forward, to facilitate the suturing.

Of the twenty-three cases of penetrating wounds of the heart, where suturing was performed, sixteen died and seventeen recovered. The left auricle was penetrated in one case, the right ventricle in six cases

and the left ventricle in fifteen cases. The mortality in this series is 70 per cent.; the mortality of heart wounds not operated upon is more than 90 per cent.

Watten's¹ case is the second in this series of twenty-three punctured wounds of the heart, in which the external wound was to the right of the sternum. The patient was in profound shock and unconscious upon his admission to the hospital. In the fourth interspace on the right side there was an oblique incised wound, about one inch long, reaching to one-half inch of the sternal border. The heart dulness was not increased, and the sounds were barely audible. While exploring the wound air entered the pericardium, and immediately a noise was heard like that of water boiling in a closed vessel. As the right pleura was already wounded, Watten decided to expose the heart by reflecting a flap to the right rather than to the left of the sternum. A triangular flap, including portions of the third and fourth ribs, was reflected, the pericardial wound enlarged, and the wound in the heart muscle exposed and closed with three interrupted silk sutures. The heart was tossing about so in the pericardial sac that he found it necessary, before he could introduce the suture, to steady the organ with two fingers introduced behind it, making gentle pressure against the sternum. From the third day on convalescence was uninterrupted, and the patient was discharged from the hospital five weeks after the accident occurred.

Nietert's collection of twenty-three cases does not include two fatal cases which Wualcker reported in the *Revue de Chirurgie*, December, 1900. In one of these eight punctured wounds had been inflicted, with suicidal intent, upon the left ventricle; they were closed with silk sutures, the patient dying thirteen hours after the injury. The wound in the second case was just below the costal border, passing through the diaphragm, pleura, and pericardium, and finally penetrating the heart. The ribs from the fourth to the seventh were resected, and the wound in the heart closed. This step of the operation was attended with some difficulty, since the stitches introduced through the heart muscle all cut through, so that it was necessary to include in them the pericardium and pledgets of gauze. The patient survived the operation only three-quarters of an hour. Wualcker relates his experience with two other punctured wounds of the heart; one of them recovered, although the wound was only tamponed and not sutured.

Tubercular Pericarditis. What might be described as a rather daring plan of treatment was carried out by Rendu² on a phthisical patient who developed a large pericardial effusion, with intense dysp-

¹ Deutsch. med. Wochenschrift, September 13, 1901.

² Bulletin de la Soc. des Hôp. de Paris, March 28, 1901.

nœa. At first 800 grm. of fluid were removed by puncture. Paracentesis was practised a second time, 1250 c.c. withdrawn, and 1 grm. of pure camphorated naphthol introduced. The reaction was marked, and manifested itself by tachycardia, pallor, and a small pulse—a picture suggesting imminent syncope. On the fifth day these alarming symptoms began to disappear.

Suppurative Pericarditis. The results which may be obtained by fearless incision into and drainage of the pericardial sac were beautifully illustrated by Mann's case,¹ a little girl just twelve years of age, who had what was believed to be an attack of appendicitis. The abdominal symptoms rapidly subsided after a free evacuation of the bowels, but there developed almost as rapidly signs of a general septic infection, manifested by synovitis of all the joints, and pericarditis. A physical examination of the chest revealed the following condition: "On examining the chest the cardiac dulness was found to be much increased, extending about three and a half inches to the right of the sternum, and on the left to the axillary line on the level of the sixth rib. Ewart's² 'pericardial dull spot' in the back was also present, extending to the middle line along the lower border of the scapula and to the left for a distance of about four inches, and reaching as high up as the spine of the scapula. The heart sounds were transmitted to the ear very indistinctly through the back. A murmur also could be heard. The heart sounds were also very indistinct through the anterior chest wall, and sounded very far off. The heart dulness was marked out on the anterior chest wall with an aniline pencil, so that any increase of the effusion might be watched." A diagnosis of suppurative pericarditis was made and a pericardotomy performed. Drs. Abercrombie and Gavin assisted at the operation. Ether was the anæsthetic. The field of operation was rendered aseptic in the usual way. A large aspirating needle was pushed through the fifth intercostal space to ascertain the character of the fluid, and at once came in contact with the heart; the violent cardiac pulsations against the needle being plainly felt. No fluid could be aspirated, except a few drops of blood. The needle was then withdrawn and introduced through the fourth intercostal space, about two inches to the left of the border of the sternum. The resistance disappearing, the needle was found to be in a cavity, with the heart pulsating against it. On making the vacuum in the aspirator, about two drachms of a bloody, purulent fluid were drawn out. The needle was then disconnected from the aspirator, but allowed to remain in the pericardium, to serve as a guide. An incision, four and a half

¹ *Annals of Surgery*, vol. xxxiv., No. 4.

² *British Medical Journal*, January 23, 1897.

inches long, was made parallel with the border of the sternum and two inches to the left down to the ribs. Two inches of the fourth rib were resected, the internal mammary artery was ligated, and the pericardium then opened, whereupon a quantity of a purulent, bloody fluid ran out. The pleura was not seen, being pushed out of the way to the left. The heart was suspended in the large pericardial sac in close relation to the anterior chest wall, the pericardium being much distended. The fluid was nearly all posterior to the heart, as in a case related by Money,¹ where, at an autopsy, twenty-four fluidounces of pus were found in the pericardium, "almost entirely stowed away behind the heart." The patient was then rolled over on the left side, and about 800 c.cm. of pus ran out. On placing the patient on her back the pericardium did not collapse very much, not coming in contact with the heart, the heart being suspended by its great vessels, and pulsating in space, so to speak. The pericardium was then freely opened and stitched to the edges of the wound, and a long strip of sterilized gauze was put in the pericardial sac below and behind the heart; a large sterile dressing was then applied and the patient returned to bed in good condition. The temperature and pulse did not drop very much, reaching 103.4° F. and 140, respectively, during the evening. The next day she was comfortable; no distress in breathing, but the temperature and pulse continued high. The convalescence was uninterrupted; in the course of three weeks the wound was healed and the patient out of bed. A year later the patient was in excellent health. Pure cultures of the pneumococcus were obtained from the effusion.

The case presented many interesting features; first of all, the development of a metastatic lesion after an acute appendicitis; secondly, the presence of a large area of pericardial dulness in the sac and extremely feeble heart sounds, notwithstanding the heart was in direct contact with the chest wall; thirdly, as demonstrating how impossible it would be to evacuate all the pus, no matter where the needle was introduced, owing to the extreme depth of the pericardial sac and the position of the heart; and, lastly, the recovery of the patient, which Mann attributes to the comparatively low virulence of the pneumococcus as compared with the ordinary pyogenic organisms, especially the streptococcus pyogenes.

Paracentesis of the Pericardium was practised by Kiliani² on a patient with subacute pericarditis; the immediate indication for operation was marked dyspnoea. Under local anæsthesia an inch and a half of the cartilage of the fourth rib was removed, an incision made in the

¹ British Medical Journal, December 1, 1888, p. 1220.

² Annals of Surgery, vol. xxxiv., No. 6.

pericardium, and the effusion evacuated. The dyspnoea was at once markedly relieved, and his recovery was practically uneventful.

Foreign Bodies in the Heart. V. Oppel¹ carried out two series of experiments upon dogs, in one of which a needle was inserted in the heart without exposing the same; the other in which a needle was introduced into the heart after its exposure. As a result of these experiments he drew the following conclusions: 1. Dogs bear more easily the introduction of a needle when the heart has not been exposed. 2. The best method of exposure of the heart is that passing through the sternum. 3. At the moment of exposure narcosis must be deep. 4. The needle may occupy a position parallel at right angles or obliquely to the axis of the heart. 5. When the needles enter the left border of the sternum the left heart is more frequently injured. 6. Wandering of the needle from the lung into the heart or within the heart itself does not take place. 7. The needle will become encapsulated in an organized thrombus. 8. The point of the needle projecting into the heart will give rise to an endocarditis. 9. In human subjects primary bleeding is frequently the cause of death. 10. In dogs this seldom takes place.

Were we to apply the results of these experiments to the treatment of foreign bodies in the heart of the human subject we should say that (1) in every case in which the needle has penetrated the heart it should be immediately extracted, because (*a*) the extraction of the needle soon after the injury will lead to recovery (Loison and Hahn); because (*b*) experiments show that the extraction of the needle from the heart of animals in the great majority of cases is not followed by hemorrhage; and (*c*) if the needle is allowed to remain in the heart it may lead to lacerations of the myocardium and fatal hemorrhage. (2) If the needle cannot be felt externally its position may be determined by the use of the Röntgen ray. One should not hesitate to expose the heart and remove the object at once, since pericardiotomy is not of itself a dangerous operation, and its extraction is more dangerous as each day or even hour passes. These dangers consist in the possibility of aneurismal formation, endocarditis, degenerative changes of the myocardium, and infection of the myocardium and cavities of the heart along the track made by the needle.

In the case of wounds from such objects as blades of knives or scissors the same indications for prompt and active treatment hold good. If the foreign bodies are of greater dimensions than a needle their extraction must always be preceded by exposure of the heart in order to be able to keep under control the hemorrhage, which in these cases is relatively freer.

¹ Arch. f. klin. Chir., 1901, vol. lxxiii.

Résumé. Needles which penetrate into the human heart should be extracted as soon as possible. Preliminary exposure of the heart is not absolutely necessary, but depends upon the circumstances of the case. After the lapse of two to five days the extraction itself, after preliminary exposure of the heart, is attended with special great dangers; under favorable circumstances the needle may remain in the heart of a man or a dog without producing injurious effects. The extraction of large bodies (foreign) from the heart can only be accomplished after the heart has been exposed.

Wounds of Large Vessels. Halstead¹ has contributed a very instructive and comprehensive article upon the suturing of wounds of large vessels in connection with the report of a case of recovery after suture of a wound of the axillary artery. The accident to the axillary artery occurred during an operation for removal of carcinoma of the mammary gland and axillary lymphatics. While dissecting the tumor free from the artery to which it was adherent the vessel was accidentally cut obliquely through about two-thirds of its circumference. The hemorrhage was readily controlled by pressing with the index finger the artery against the clavicle. Inasmuch as there was practically no chance for the establishment of a collateral circulation, since all the branches of the artery save the circumflex had been cut, the only chance of saving the arm was to repair the wound of the artery. This was accomplished with four interrupted catgut sutures, which included only the two outer coats of the vessel. To support these sutures the perivascular connective tissue was sutured longitudinally over the vessels with a fine catgut suture. The radial pulse immediately restored, and the patient suffered no ill effects from this accidental injury.

The result of experiments by such men as Schede, Glück, Von Horoch, Jassinowsky, and others have demonstrated beyond question the practicability of closing wounds of vessels, both oblique and longitudinal, both complete and incomplete, without any serious risk of subsequent aneurismal formation or secondary hemorrhage. According to Halstead, the indications for arterial sutures are, first, all cases of injury to a vessel or vessels where a ligature might bring about serious nutritional changes to the part supplied by the injured vessels. This is especially apt to occur when the corresponding vein is injured at the same time. In such cases an effort should be made to repair both vessels, although if the arterial circulation is established the necessity of restoring the continuity of the vein is not so imperative; secondly, all wounds of large vessels produced by puncture, gunshot wounds, or

¹ Medical Record, July 20, 1901.

laceration ; thirdly, operation wounds of large vessels, accidental or intentional, as when, for any reason, a part of the vessel must be sacrificed. The method of closing the wound depends upon whether or not the wound involves more than one-half of the circumference of the vessel. If less than one-half of the circumference of the vessel is involved a few interrupted sutures, if the wound be transverse or oblique, and a continuous suture, if the wound be longitudinal, will suffice to effect its closure. When the wound involves more than one-half the circumference of the vessel, resection and end-to-end union by invagination constitute the best method of treatment. When this method is carried out there is always the possibility of the artery becoming ultimately obliterated as a result of an endothelial proliferation ; but this should not constitute a contraindication, since before the vessel has become entirely obliterated a sufficient collateral circulation may have been established to prevent any serious nutritional disturbances. This radical method of treating arterial wounds is applicable, of course, only to the larger vessels, particularly the aorta, popliteal, and common carotid, subclavian, axillary, femoral, and iliac. There are a few points in the technique which are worthy of consideration. First, as to the method of temporarily controlling the flow of blood through the vessels. This Halstead believes is best accomplished by passing a loop of tape around the vessel and twisting it until its lumen is closed. This method subjects the vessel to the least traumatism, and at the same time avoids what risk of infection may be feared from digital compression.

As to the selection of suture material, both catgut and silk have their advocates. It is claimed for catgut that when it becomes moistened it swells and closes the needle punctures, and thus controls the hemorrhage which frequently occurs ; and for silk, that being non-absorbable, it acts as a foreign body and stimulates the proliferation of the connective tissue and endothelial cells, thereby strengthening the cicatrix. There is some difference of opinion as to the necessity of including the intima in the suture. Some, particularly Jassinowsky, believe that if the suture does not include the intima the risk of thrombus and hemorrhage from needle punctures is lessened.

Many mechanical appliances have been recommended and employed experimentally in effecting end-to-end union of arteries ; from the practical stand-point, however, the invagination method of Murphy is the best. This is applicable to complete wounds and to wounds involving more than one-half the circumference of the vessel ; the proximal end is invaginated into the distal by means of two or three silk sutures, and four or five interrupted sutures, including the adventitia and media of the invaginated vessel, are used to bind the two together.

Ligation of the Innominate Artery. Exposure of the structures in the anterior mediastinum is, according to Curtis,¹ best obtained by Milton's method, which consists in a longitudinal division of the sternum. It has great advantages over those methods which consist in a resection of all or a portion of the manubrium together with the costal cartilage. Its execution is simple, it affords sufficient space in which to carry out the subsequent steps of the operation, and completely restores the solidity of the chest. In addition to these recognized advantages, Milton's method minimizes certain dangers common to the others, as, for example, the danger of injury to the pleura, of infection, necroses, and non-union of the resected flap. As a preliminary operation to ligation of the innominate artery Curtis employed a slight modification of Milton's method, which consists essentially in splitting only the manubrium, not the entire sternum, and in dividing the bone transversely at the lower border of the first intercostal space. Sufficient exposure of the great vessels at the root of the neck and of the lower portion of the trachea is obtained by limitation of the bone-cutting to the manubrium, and the danger of injuring the pleura is very much less for two reasons: First, because at the level of the manubrium they are separated by a wider margin than they are further down, and, secondly, because at that point they are well protected by the sternothyroid muscles. After transverse division of the two halves of the manubrium the bones can be retracted so as to leave an interval of one or two inches. The steps of this modified operation are as follows:

1. A median incision is made from the larynx to the middle of the sternum or lower, dividing the skin and deep fascia above and the periosteum also below.
2. The sternohyoid and sternothyroid muscles are followed down to their sternal insertion, retractors being placed so as to draw the soft parts at the base of the neck widely apart.
3. A transverse incision is made through the periosteum along the upper border of the manubrium, and the periosteum and muscles detached from the posterior surface of the bone by blunt elevators and the finger as far as can be reached.
4. The ordinary amputation saw is then applied to the bone in the line of the vertical incision in the periosteum, the soft parts in the neck and behind the sternum being protected by flat metal strips. The saw is held with its point turned toward the neck and its handle toward the ensiform cartilage. It should cut most deeply above and entirely divide the manubrium at its upper border, the cut being more shallow below, and only grooving the bone at its lower end. This obliquity of the cut necessitates the long skin incision which has been described.
5. A stout chisel is then applied

¹ *Annals of Surgery*, vol. xxxiv., No. 4.

in the saw-cut at the superior border of the manubrium, and the thin layer of undivided bone on the posterior surface is made to give way as the wedge action of the chisel forces the two halves apart. 6. The skin being well retracted, a transverse incision is made in the periosteum across the face of the bone at the level of the first or second intercostal space, and the chisel is applied in this line directed obliquely outward from the middle line on each side, so as to divide each half of the bone from the body of the sternum. The instrument must not be allowed to cut entirely through the bone at the outer border, for fear of injury to the pleura or internal mammary artery. Both lie a little distance from the bone, so that the danger of wounding them is not great. 7. Strong retractors are then inserted in the median saw-cut, and with a little force the two halves can be sufficiently separated to allow access to the periosteum, which should be carefully incised or scratched through with the point of the knife, beginning above, where the danger of damage to the subjacent parts is least. As the periosteum is divided the halves of the bone can be more widely separated, and this interval gradually extends from an inch to nearly twice that distance as the steady, strong traction is maintained during the subsequent operation. A separation of three centimetres can be obtained in any case, and this is abundant. The small intercostal branches of the internal mammary artery are somewhat tortuous and sufficiently long to allow free motion of the bone without receiving injury. 8. The muscles and fascia are then divided by blunt dissection, or with forceps and scissors, in the median line, beginning above, double ligatures being applied to the veins which cross the line of incision. The trachea and great vessels at the root of the neck can be freely exposed. In the case of operation for ligature of the innominate described, the nerves were not seen at all, and even in a ligature of the first part of the subclavian by this method I do not believe there would be any danger to the recurrent laryngeal nerve, because the sheath of the vessel would be opened as soon as it was exposed, and the subsequent manipulations would take place within the sheath completely separated from the nerve. In applying a ligature to the innominate artery it should not be forgotten that a small arteriole sometimes takes origin from that vessel on its superior surface, which might give trouble to the operator.

In the case reported by Curtis the common carotid and subclavian arteries were each an inch in diameter, and the innominate an inch and a half. The common carotid was so large that at first it was mistaken for the innominate. The innominate was finally isolated and a double chromicized catgut ligature thrown around it. The artery was folded in on itself, in order to avoid crumpling while tying the knot, and the ligature was only drawn tight enough to arrest pulsation. A second

ligature of the same size was passed through the same opening as the first and tied obliquely, so that it lay in front about a quarter of an inch distally from the first. After ligating a few veins passing toward the thyroid gland the bone was replaced and the two halves united with two silver-wire sutures. Slight pulsation was observed in the aneurism four days after ligation, and as this continued slowly to increase it was determined to apply additional ligatures. Accordingly, about three months later, "under ether anæsthesia, an incision was made along the inner border of the sternomastoid muscle and the carotid exposed. No pulsation was observed in the lower part of the vessel, which appeared full of solid blood-clot, but for safety a ligature was placed around it and tied without dividing the coats of the vessel. Another incision was made along the clavicle from the lower end of the first, and a third obliquely downward and outward from the same point. The clavicle was thus exposed and divided between the inner and middle thirds with a Gigli wire saw. The first part of the subclavian was thus brought into view, and found to have a faint but decided pulsation. The innominate was evidently impervious. The subclavian and the carotid had both regained a normal calibre, being much smaller than at the previous operation. There was no clot in the subclavian. The aneurismal dilatation began in the second portion. Pressure at different points proved that the pulsation in the sac was not retrograde, and that it must come from some branch of the first part of the subclavian just beyond (distal to) the thyroid axis. This arrested pulsation in the sac, but it continued in the first part of the subclavian. Beyond the ligature (distally) was a small vertical branch, which was assumed to be an irregular vertebral, although it was small and did not pulsate. Another ligature was thrown around the subclavian just beyond (distal to) this branch. No vertebral artery could be found arising centrally to the thyroid axis, and it was believed that the remaining pulsation in that part of the vessel came from the internal mammary artery."

Aneurisms. The treatment of aneurisms of the aorta by the introduction of wire and electricity has been summed up by Willard¹ in connection with his report of the twenty-fourth case in which this method was carried out. In one-half of the cases operated upon life was certainly lengthened, and those who survived the immediate effects of the operation were rendered vastly more comfortable. In ten cases the lives were undoubtedly shortened by the operation, though some of these were unsuitable subjects. Rosenstirn's case was alive eleven years after the operation; Stewart's case three and a half years, and

¹ *Annals of Surgery*, vol. xxxiv., No. 1.

the autopsy showed a solidly coagulated tumor ; in Kerr's case there was no recurrence at the end of ten months ; Noble's case died of dysentery nine months later, without recurrence ; Finney's case was at the last report alive, with great improvement of symptoms. Three of Hare's cases survived more than six months, and were for a time, at least, more comfortable, and life was prolonged. Of the entire series ten have been positively benefited, one is uncertain, while the remainder died within a year, all having been rendered decidedly more comfortable. Willard's patient, a man aged twenty-three years, had been struck on the chest by a box weighing 500 or 600 pounds. Thirteen months after the injury he was admitted to the hospital, when he presented the symptoms of a traumatic aneurism of the descending thoracic aorta. As the conditions were growing rapidly worse under medicinal treatment and restriction of diet, he expressed his willingness to take the only chance of saving his life. It was the intention of the operator to use No. 35 gold wire, but this proved too fine, as it would not pass through the canula without kinking. No. 24 silver wire was substituted, and after six or eight feet had been inserted the current was turned on ; at first five milliampères, the current was slowly increased until, during the last fifteen minutes of the hour, the strength was eighty milliampères. In the meantime about twenty feet of coils had been introduced. The patient complained of pain chiefly on the back where the electrode was applied. The improvement following the operation was as rapid as it was marked ; within six days he was anxious to get up out of bed ; his oppression was much less marked, his pain had vanished, the pulsation in the sac had diminished 25 per cent. "The original point of thinning anteriorly is much more solid, but laterally below the axilla the pulsation was slightly increasing, and will probably require a repetition of the operation." Nine weeks afterward the patient felt so well that he could not be restrained from leaving the hospital, although it was evident that dilatation of the sac was taking place outward into the axilla and that the operation should be repeated. The patient returned two months later suffering with increased dyspnoea and pain. Twenty feet of No. 24 silver wire were inserted and a galvanic current of eighty milliamperes applied for an hour. This second operation failed to produce coagulation in the right thorax, the tumor rapidly increased in size, and the patient died from exhaustion four weeks after the second, five months after the first operation.

Since the appearance of Willard's article, Freeman and Hall¹ have contributed two additional cases. The first case was one of aneurism of the arch of the aorta. Repeated injections of a 1 per cent. salt solu-

¹ American Journal of the Medical Sciences, December, 1901.

tion of gelatin and ligation of the right carotid and subclavian arteries failed to afford any relief. Six feet of No. 27 silver wire were introduced and a current of 75 milliampères applied for thirty minutes ; on four occasions during the succeeding week the gelatin solution was injected. Seven months after the operation the tumor had disappeared a slight pulsation had returned to the radial artery, the right pupil was moderately contracted, and there was no dysphagia. There was a small, fistulous opening leading down to the wire. The patient resumed his work as a day laborer, but returned again about three months later with a portion of the wire presenting at the mouth of the sinus. The wire was easily removed, coming out in a small bunch, but its removal was followed by a severe hemorrhage, probably due to ulceration. This was followed at intervals of a few days by other hemorrhages. The aneurism rapidly reformed and dyspnoea became extreme. Though the patient's condition was alarming, fifteen feet of No. 27 uncoiled wire were introduced and a current varying from fifty to seventy-five milliampères applied for thirty-five minutes. The patient bore the operation well, but died in sixty hours, evidently from pressure on the trachea ; the autopsy revealed a firm, satisfactory clot filling the entire aneurism.

The second case, also one of aortic aneurism, was particularly interesting as demonstrating the importance of repeating the operation whenever there is evidence of increasing dilatation of the sac. The first operation was performed on December 24th, when twenty-two feet of No. 27 silver wire were introduced under local anæsthesia and seventy milliampères applied for sixty-five minutes. Apart from a slowing of the pulse from 90 to 52, due probably to overstimulation of the vagus, no ill effects were noted. On February 20th, March 15th, and April 30th the operation was repeated, and on each of these occasions there was some return of pulsation. From the date of the last operation until October 16th, when the last observation was made, there has been no evidence of recurrence, the patient continues in good health, and has resumed his occupation as hotel manager.

There are some points in the technique of this procedure that are the subject of comment by Freeman and Willard. First, as to the character of the wire : Freeman takes exception to the conclusions drawn by Hunner from his observations upon the behavior of highly-drawn wire when introduced into a glass flask, on the grounds that glass flasks do not represent the conditions as they exist in the aneurismal sac ; the inside of the aneurism is not hard and smooth as a glass flask, but often irregular and coated with rough layers of clot. In order to represent the conditions more accurately he hollowed out a large Colorado turnip, and as a result of his experiments with various

kinds of wire he was convinced that the glass flask method had led to erroneous and misleading conclusions. Freeman, comparing the deportment of the hard with the soft wire upon its introduction into the turnip, became convinced that the soft was in every way superior to the hard, elastic variety, and for the following reasons: hard, elastic wire kinks and breaks more easily, does not coil so satisfactorily, and is more liable to protrude through an aortic opening; its sudden movements during introduction may develop clots, and its inherent springiness would tend to prevent contraction of the sac wall. Soft, unalloyed wire has another advantage over the hard in that it more rapidly loses in size under the influence of the electric current, and becomes much rougher and more brittle. Willard sees no practical difference between silver, gold, and platinum wire.

As to the quantity of wire to be used, Freeman admits that this is still an open question, although he says "the employment of considerable wire has, within reason, some theoretical advantages without counterbalancing disadvantages, and that it has never been given a fair trial." The arguments of Stewart, Hunner, and others in behalf of a small amount are open to question. In the first place, it seems sufficiently evident that the greater the quantity of wire the more certainly and quickly will the clot form, and the firmer will the clot be; in the second place, the presence of a large amount of wire, if it be of the soft variety, should not prevent the contraction of the clot after it has become organized; thirdly, it is questionable whether the results thus far obtained can be interpreted as supporting one or the other material; lastly, it is a question as to what should constitute little and what a considerable amount of wire. Willard states that probably five or twenty feet would be the proper amount. He suggests that the wire be previously wound, so as to coil and snarl in different directions, using for the purpose, for example, a rolled sterilized towel if the aneurism be large, and a glass spool if the aneurism be small. It is of the utmost importance that the tissues about the canula be protected from the galvanism, lest an open sloughing track be made into the aneurism.

Freeman calls attention to the desirability of introducing the canula just within the sac, and no further. If the canula is inserted too far the wire has a tendency to coil up in the opposite wall, leaving a more or less clear space around the point of entrance.

There seems to be some difference of opinion as to what strength of current produces the best results. Stewart and others insist upon the use of a rather strong current—about seventy to eighty milliamperes—although Hunner objects to this on the ground that there is danger of disintegration of the sac, or even of the aorta itself in case of misplacement of the wire. Hunner's opinion was based upon his experiments

in rapidly moving blood in a dog's aorta, but, Freeman rightly observes, this experiment is hardly a fair test, inasmuch as the blood in aneurisms does not move with anywhere near the rapidity that it does within the aorta. The danger of injuring the aorta or the sac wall by a current of seventy or eighty milliamperes is probably very remote. So far as known it has never occurred, and is more than counterbalanced by the advantages obtained. In support of a strong current, it may be said that Freeman found by conducting experiments upon clotted blood, that the diameter of the area acted on by a current of one hundred milliamperes was several times greater than that effected by ten milliamperes during the same length of time.

Freeman disagrees with Stewart and Hunner in that he does not believe there is any danger of rupture of the sac following clotting of blood in but a portion of the sac. Hunner claims that this will expose the remainder to increased pressure. Freeman claims that the pressure upon the remainder of the wall is not increased, and proved this point to his own satisfaction in a rather ingenious way: He fastened a rubber glove to a fountain-syringe filled with water, and elevated the syringe. The glove represented an aneurism, and the force of the water in the douche bag took the place of the pressure of the blood, this force being measurable by the height to which a fine stream of water was projected through a hole in one of the glove fingers. After the insertion of a large solid body within the glove, to represent a clot, it was noted that the stream projected to exactly the same height as before, thus demonstrating that there was absolutely no increase of pressure.

In the discussion of Willard's paper, already referred to, at the meeting of the Philadelphia Academy of Surgery, D. D. Stewart describes the technique which he now employs. He prefers gold to silver wire, because it can be more tightly drawn; and it is important that the wire assume spiral coils and will not be easily deflected by loose coagula. He still believes it advisable to use a small amount of wire, chiefly because a large quantity will prevent subsequent contraction of the aneurismal sac. The interior of the sac is better reached by a smaller quantity of wire if the latter be introduced through several openings, and for this reason he usually employs two or more insulated needles. Concerning the strength of the current, he was inclined to believe from clinical observations that too strong a current would soften the clot; the maximum current should not exceed seventy to eighty milliamperes; the current should be turned on gradually, so that the maximum is reached in about ten minutes, and after maintaining it at the required strength for the requisite time it is gradually diminished to zero. It is desirable to obtain all the conditions favorable to the formation of the clot, particularly a low blood-pressure; to this end a course of

aconite should be given before the operation, and to allay pain and nervousness during the operation, a hypodermic of morphine.

Arterio-venous Aneurism of the Subclavian Vessels. Larrey described the first of these injuries in 1829, since which time some twenty-three cases have been recorded, but only four subjected to operation. Before the meeting of the American Surgical Association in 1901 Matas presented the report of an arterio-venous aneurism of the subclavian vessels, due to a bullet wound; in addition to the wound of the vessels there was an injury of the brachial plexus, causing paralysis of the upper extremity. The operation, performed some ten days after the injury, and carried out under infiltration anæsthesia, consisted in a disarticulation of the sternoclavicular articulation and the application of a temporary ligature around the anomalous subclavian, the innominate being absent. When the artery was dissected free from the vein there was profuse hemorrhage, coming evidently from the distal portion of the vessel, which was at once controlled by the application of ligatures on the proximal and distal side of the aneurism. The wound in the vein was closed by lateral sutures and the venous circulation re-established. The patient recovered from the operation with the loss of a portion of the hand and forearm, due evidently to the arrest of circulation and insufficient collateral circulation.

Another of these unusual injuries was reported during the past year by Gallois and Piollet¹ in connection with a collection of cases illustrating lacerations of large bloodvessels complicating simple fracture of the clavicle. All told, the series includes but eleven cases, with the following lesions: In two the internal jugular vein was involved; in six the subclavian vein, four times alone and twice with the subclavian artery, and in three the subclavian artery; in one case the suprascapular or transverse cervical was the vessel injured, and in the author's original case there was not only a large arterio-venous aneurism of the subclavian vessels, but a laceration of the internal jugular vein. The list will be of interest chiefly to those seeking statistics of complications of fractures or injuries to large bloodvessels, but is also of some historic interest in that it includes the case of Sir Robert Peel. There is little to be said of the symptomatology or of the indications for operation; the principles applicable to wounds of these large vessels under other circumstances are applicable here. The mortality is, as we would expect, high; eight of the eleven accidents were fatal.

Treatment of Aneurism by Gelatin. Lancereaux's treatment of thoracic aneurisms by the subcutaneous injection of a 1 per cent. solution of gelatin undoubtedly has some merits, although the results are

¹ *Revue de Chirurgie*, July and August, 1901.

by no means uniformly good. Lancereaux¹ attributes the many failures which have been recorded to two causes: (1) Because it has been used in unsuitable cases, *e. g.*, fusiform aneurisms; (2) because the technique has been arbitrarily modified; not only have the doses been insufficient—20 to 30 c.c. instead of 200 to 250 c.c.—but the number of injections have been too few—two or three instead of from fifteen to thirty. He claims that if the solution is injected slowly into the cellular tissue that the injections will be painless, and, if aseptic, not attended with fever. But this does not seem to have been the experience of many other observers, who have come to regard the painfulness of the treatment and the associated chills and fever as among its chief objections. Of the last four cases in which Lancereaux has applied the treatment, two—one of the right subclavian and one of the arch of the aorta—of the tumors have decreased in size, the pulsation is less marked, and the general condition of the patient improved. In two other cases of aortic aneurism there has been a very marked improvement.

Perhaps a more comprehensive view of the results of this treatment may be obtained by referring to the forty-eight cases which Sörgo² collected. Excluding fourteen from these on account of insufficient data, he found that in thirteen coagulation had taken place and that in twenty-one there was no improvement; of the thirty-four reliable cases sixteen were saccular aneurisms, the remainder being of the fusiform type. In none of the latter was any improvement noted, while the thirteen which consolidated were all cases of saccular aneurisms. If Lancereaux regards the fusiform as unsuited for this method of treatment, and if these figures are correct, the results can be interpreted only as a strong testimonial in favor of the gelatin treatment. Sörgo is not willing to admit that the subcutaneous injection of gelatin actually increases the coagulability of the blood, and believes the manner in which the results are obtained is still unexplained. This view seems to have been based upon the results of animal research.

The gelatin treatment is certainly deserving of continued trial, and by collecting the accumulating evidence we will be able to estimate its true inherent value. The results which Conner³ obtained in his three cases of thoracic aneurism were not encouraging, but this may have been due to the fact that the treatment could not be carried out fully. Case I., an aneurism of the descending aorta, received three injections, and died of rupture of the aneurism while under treatment. The autopsy revealed no evidence at all of a thrombus, although the condition—that of a large sac, with a small communication into the aorta—was

¹ Bull. de l'Acad. de Méd., July 16, No. 1.

² Zeitschrift f. klin. Medicin, Bd. xliii., Heft 1 u. 2.

³ Medical News, March 16, 1901.

an especially favorable one for clotting. Case II., an aneurism of the transverse and descending portion of the arch and of the innominate artery, received seven injections, which were associated with severe local pain and but little improvement. Case III., an aneurism of the transverse arch, received three injections without the slightest improvement. In all three cases the greatest care was exercised in the preparation and sterilization of the gelatin solution.

Aside from pain and local irritation, no untoward symptoms were noted. He did not see, what Lancereaux led him to believe he would, namely, a distinct improvement after single injections. Both Conner and Sargo call attention to the possibility of fallaciously attributing the improvement that may follow to the gelatin injections when it might very well be explained by the enforced rest and restricted diet which constitutes a part of the treatment; and should the treatment run along over a period of five months, as would be likely if twenty injections were given, it is more than likely that rest would of itself cause some amelioration of the condition.

BREAST.

Mastitis Adolescentium. The case reported by Adler¹ is interesting as being one of four cases in which a histological examination of the specimens was made. Clinically, mastitis adolescentium is a painful swelling of one or both mammary glands, common to both sexes at the period of adolescence, terminating, as a rule, in resolution. The process is essentially an hyperæmia, but in no sense an inflammation, which results in a physiological or possibly atavistic hypertrophy of the gland. Suppuration never occurs unless as a result of mixed infection. The treatment is either protective or, in severe cases, extirpation. Adler recommends the use of a celluloid shield for protection, with or without the application of such placebos as iodine or blue ointment. If extirpation is practised the nipple should be left intact for cosmetic purposes.

Mastitis in Typhoid Fever, though not a very common complication, was observed as early as 1874. In the majority of cases hitherto reported the infectious process makes itself manifest in about the fourth week; the gland becomes swollen, tender, and red, and the temperature, which had returned to normal, begins to fluctuate. The tendency of this specific inflammation is toward spontaneous resolution; but occasionally, as in the case reported by Davis,² the process advances to the

¹ Deutsche med. Wochenschrift, January 31, 1901.

² American Journal of the Medical Sciences, December, 1901.

stage of suppuration, and is associated with a temperature of a septic type, with a leucocytosis and with inflammation of the axillary lymphatic glands. Davis' patient was in her thirty-fourth year, and on the thirty-ninth day of the disease she began to complain of tenderness in the left breast, and three days later in the right breast. The temperature, which had just returned to normal, began to assume a hectic type. On the twelfth day fluctuation was detected in the left breast, and, on aspiration, a small amount of thick pus was obtained; on the following day a free incision was made into the abscess and 150 c.c. of pus evacuated. The inflammation of the right breast terminated in resolution. A bacteriological examination of the pus aspirated from the left breast revealed a pure culture of the typhoid bacillus. The source of infection in typhoid mastitis is probably through the blood, although in two attempts Davis failed to obtain any cultures. The exciting cause is therefore the typhoid bacillus; the predisposing cause, according to Capellari, is the age of puberty, because at that age the mammary glands are less resistant, owing to their rapid growth, and become, as it were, a *locus minoris resistentiae*. Since it is known that bacteria circulating in the blood may pass into the milk, an attempt was made in guinea-pigs to obtain typhoid bacilli in the milk, but with negative results. Despite the fact that these experiments were negative, it seems at least probable, when the breast is the seat of a typhoid inflammation, that typhoid bacilli might appear in the milk of a nursing woman either during or after an attack of typhoid fever.

Mammary Tuberculosis is usually secondary to a tuberculous lesion elsewhere; the infecting bacterium gains access to the gland through the medium of the circulation, and sets up the characteristic lesions of tuberculosis; the gland becomes riddled with abscesses, which discharge their contents spontaneously through the milk ducts and through fistulous tracts. Insidious of onset, the subsequent course is particularly slow. Pluyette¹ reports such a case in a girl, aged twenty-three years, who five months before was in the best of health. The infection, apparently a primary one, as all the other organs were normal, gained access to the gland through an erosion at the level of the areola. The process must have been unusually rapid, since within two months the entire gland was destroyed and was the seat of a large tuberculous abscess. The axillary lymphatics were not enlarged.

The Surgery of Mammary Carcinoma. Surgeons throughout the world fully comprehend the importance of an early and, above all, a radical operation in the treatment of operable malignant growths of the female breast. Little time is being wasted in exploiting before the

¹ *Gazette hebdomadaire de Médecine et de Chirurgie*, December 27, 1900.

medical public alleged improvements in technique, but much time is being devoted in the operating-room to prolonged dissections of the axillary, the subclavicular, the supraclavicular, and post-cervical regions. Every surgeon is now busily engaged in tabulating his statistics in such a way that he can compare the results, as to permanent cure, of the radical operation of to-day with those of a decade ago. As an evidence of the satisfaction on the part of surgeons with the present surgical treatment of mammary cancers I would call attention to the programmes of the last meetings of the *Deutsche Gesellschaft für Chirurgie*, of the *American Surgical Association*, and of the *British Medical Association*, where there will be found but one contribution on this subject, and that only a brief consideration of the statistics.

The increase in the percentage of permanent cures is to be attributed in part to our acquired knowledge of the lymphatic outlet of the mammary gland and to the more intelligent plan of operation which this has led up to ; in part to the recognition, on the part of the general practitioners, of the importance of early operative intervention, and in part to the more hopeful view of the operative results taken by the public. Our statistics could be considerably enhanced in value were more attention paid to the classification of cases. Recurrence, local or diffuse, depends upon so many other factors than the thoroughness of the operation that it is of the utmost importance that a classification be formulated which would be acceptable to and adopted by surgeons of both hemispheres. Cases should be classified according to age, for the younger the patient the more malignant the growth, according to the seat of the growth, according to the variety of the tumor, and the nature of the operation ; these are but a few, and perhaps the most important, of the clinical features that seem to have a bearing upon the percentage of recoveries. Halstead tabulates his cases as follows : (1) Those in which the axillary glands were removed at the first operation ; (2) those in which the axillary glands were removed at the first operation, the cervical at the second ; (3) those in which the cervical glands were not removed. In the first class local recurrence occurred in 11 per cent., in the second in 20 per cent., and in the third in 9 per cent. ; the percentage of cures was in the first class 45 per cent., in the second class 33 per cent., and in the third class 43 per cent.

From 1896 to 1900, in Eiselberg's clinic, 162 carcinomata of the breast were removed, and of these the permanent results were given in 107 ; 44 died, 25 with local recurrence, 16 of inner metastasis. Of the living 9 had local recurrence or metastasis, and 54 remained free from recurrence ; the percentage of permanent cures was 22.7 per cent. In 124 cases the pectoral fascia was removed, in 68 the pectoralis major, in 39 the pectoralis minor, and in 17 the supraclavicular glands.

Recently the pectoralis major and minor were removed in every case according to Rotter's method. Of 200 cases of mammary carcinoma removed by Halstead three or more years ago the percentage of cures averages about 40 per cent.

Dentu¹ records his results in 53 cases, as follows : Of the entire series 36 have died, the average expectation of life being three years, six months, and five days.

1. Sixteen, or 44 per cent., lived three years, with or without recurrence :

From 3 to 4 years	.	.	.	.	.	.	4 cases.
" 4 " 5 "	.	.	.	.	.	.	6 "
" 6 " 7 "	.	.	.	.	.	.	1 "
" 7 " 8 "	.	.	.	.	.	.	1 "
" 8 " 9 "	.	.	.	.	.	.	1 "
For 9 "	.	.	.	.	.	.	1 "
" 10 "	.	.	.	.	.	.	1 "
" 13 "	.	.	.	.	.	.	1 "
Total	.	.	.	.	.	.	16 "

CAUSES OF DEATH.

Intercurrent maladies	.	.	.	.	.	.	5
Local recurrence	.	.	.	.	.	.	13 = 36 per ct.
Local and general recurrence	.	.	.	.	.	.	12 = 33 "
General without local recurrence	.	.	.	.	.	.	6 = 16 "

2. Seventeen cases are still alive, and of these the average duration of life is six years one month and twenty-seven days. Seven of these cases have lived less than three years, as follows :

Between 6 months and 1 year	.	.	.	.	.	.	3
" 1 year " 2 years	.	.	.	.	.	.	1
" 2 years " 3 "	.	.	.	.	.	.	3
							7

Ten of the seventeen survivors, or 58 per cent., are divided as follows :

Between 3 and 4 years	.	.	.	.	.	.	1 case.
" 4 " 5 "	.	.	.	.	.	.	1 "
" 5 " 6 "	.	.	.	.	.	.	2 "
" 10 " 11 "	.	.	.	.	.	.	1 "
" 12 " 13 "	.	.	.	.	.	.	2 "
" 31 " 14 "	.	.	.	.	.	.	3 "

Only three of the seventeen survivors have had recurrence.

Treatment of Inoperable Carcinoma of the Breast. THE RÖNTGEN RAYS. We have already had occasion to refer to the brilliant results of the effect of the Röntgen rays upon superficial malignant growths, particularly epitheliomata of the face. Andrew Clark² tried the effect of this

¹ *Revue de Chirurgie*, 1901, No. 11.

² *British Medical Journal*, June 8, 1901.

treatment upon an inoperable carcinoma of the breast, with results that were most encouraging. At the time treatment was instituted the breast consisted almost entirely of a red, ulcerating surface, with a hard margin, and was firmly fixed to the chest wall. Under the skin, on the margin of the ulcerating surface toward the axilla, there was a hard, fixed mass, and in the axilla were several indurated glands, immobile and the size of a hazel-nut. The rays were applied five times a week for a period of fifteen minutes. In the course of two months there was a very astonishing improvement both in the local and general condition; the ulcerating surface was smaller, the induration diminished, and the axillary glands appreciably smaller.

OÖPHORECTOMY FOR INOPERABLE CANCER OF THE BREAST. In such desperately hopeless cases as those of inoperable cancers of the breast, surgeons are willing to give trial to any method of treatment that offers one ray of hope. In 1896 Beatson, of Glasgow, recommended the removal of the ovaries, on the ground that those organs were directly responsible for the proliferation of epithelial cells as seen in carcinoma. Many an oöphorectomy was practised, but the results, on the whole, were not sufficiently good to rank this operation as an established procedure in the treatment of inoperable cases. With each succeeding year Beatson's treatment has lost in popularity, so that to-day we hear only very occasionally of its being put into effect. Abbe,¹ however, was so encouraged with his results in his first two cases that he ventured to apply it in five succeeding ones. In the first case the malignant disease disappeared absolutely, and the patient was restored to perfect health; in the second case the malignant ulcer entirely healed, the nodules slowly diminished in size, and the patient regained perfect health; a third showed a temporary halt, and then progressed unretarded; the fourth and fifth have shown slight arrest and slight diminution of the recurrent nodules; the sixth, an inoperable growth under observation but one month, in a woman aged seventy-five years, shows only slight atrophy in the mass nearest the nipple, but no increase has been observed at other points. The last was operated upon but a few days before his report was published. In October, 1900, Stanley Boyd collected forty cases in which this treatment was carried out. Of these a comparative success was noted in 35 per cent. "Thus far little attempt has been made at selection, hence we may hope for much better reports when the treatment is applied to properly selected cases. One may expect improvement or occasional cures in one-third of the cases so operated upon after recurrence in apparently 'inoperable' cases. A number of recurrences were seen many months after an apparent cure by oöphorectomy, but at least

¹ New York Medical Journal, August 3, 1901.

one case had continued more than three years and a half without return. It is probable that the patients operated upon before the menopause will show the largest percentage of change, but the same effect seems to follow in patients as old even as my patient of seventy years. Incidentally, it may be remarked that in most patients reported by Boyd a striking improvement in general health followed the operation, and this has been borne out by my experience."

Abbe, in conclusion, says that whether or not we accept Mr. Beatson's view of the cause of the remarkable retrograde metamorphosis and disappearance of cancer nodules and masses in some patients following oöphorectomy, the fact remains, and we must look to the pathologist for an explanation.

SUCTION APPARATUS IN CANCER OF BREAST. The third method of treating inoperative carcinomata is not deserving of mention unless on the ground of originality or novelty. Leaf¹ has recommended the use of a suction apparatus designed and constructed with a view toward preventing dissemination of cancer. The treatment is based upon the theory that cancer juice is a medium necessary for the proliferation and active multiplication of epithelial cells, and serves as a vehicle for their dissemination. Once this medium is removed, proliferation of cells will cease and dissemination of the growth be checked. The suction apparatus is applied daily for as many hours as the patient can bear. If there is no ulcerated area or solution in the continuity of the skin, Leak advises the making of a number of puncture wounds, in order to assist the apparatus in its extraction of cancer juice from the malignant area.

Carcinoma of the Male Breast. Up to 1890 Schuchardt had collected from every source and tabulated 472 cases of carcinoma of the male breast. Warfield² has collected thirty-two cases which have been reported since 1890 up to the present time, to which he adds five cases reported for the first time, four of which occurred in the Johns Hopkins Hospital. As to the relative frequency of this affection in the two sexes, it occurs in the female about one hundred times as frequently as in the male; the fifth and sixth decades seem to be the time when the growth is most prone to appear. In one instance the tumor was noticed for a period of thirty-five years. Either breast may be affected indifferently; trauma seems to play but a slight part in the etiology, and in some cases there seems to be a relation between cancer and hypertrophy of the breast. Pain is not a prominent symptom; ulceration occurs in the minority of cases, and is usually preceded by the tumor becoming adherent to the skin. Retraction of the nipple, discharge from the

¹ Edinburgh Medical Journal, vol. ii.

² Bulletin of Johns Hopkins Hospital, vol. xii., No. 127.

nipple, and enlargement of the axillary glands are symptoms common to most cases. As to the microscopical appearance of the tumor, the majority are of the tubular type. Thirty-four cases have been operated upon, all of which were followed by recovery from the immediate effects with the exception of one, in which death ensued a few days after the operation from hypostatic congestion of the lungs. As to the ultimate results, but few of the cases have been kept under observation long enough to determine when recurrence or death may have followed. There are records of cases which have died of recurrence from one to five years after the operation, but in these only a portion of the pectoralis major muscle was removed.

Medical Aspects of Cancer. Dr. Osler¹ says the consultant physician sees cancer of the breast in two stages, the earliest and the latest manifestations of the disease. The latter may be divided into three groups—the cerebro-spinal, thoracic, and abdominal. Of the cerebro-spinal group the most interesting are those described by Charcot under the name of paraplegia dolorosa. When the consultant has been informed of the pre-existence of a primary tumor in the breast, the painful, progressive paraplegia is easily and readily explained. "The early symptoms consist usually of distinct pains, a feeling of tingling and numbness, neuralgia of great intensity, and shooting pains down the front or back of the legs; then a slight paraplegia, followed by complete paraplegia; but long before this last you have the characteristic retraction of the legs, associated with severe pain. The degree of suffering is probably as great as that seen in any other condition of medical practice." As to the prognosis, these cases must be regarded as utterly hopeless, so that once the diagnosis is made the patient should be given all the comfort and aid that medicine can offer. The thoracic group includes metastasis in the pleura, in the lungs, and in the mediastinum. Next to that of the spine, involvement of the mediastinal glands is the condition which gives the greatest degree of distress. A few months or a year following the removal of carcinoma of the breast the patient begins to have a cough or dyspnoea, without signs of effusion in either pleura; then it is known, even if the glands above the clavicle are not enlarged, that one of the worst accidents has happened. These cases are, as a rule, very distressing, and die of suffocation. There is increasing pain, dyspnoea, and pulmonary oedema. Fortunately, the duration of the illness is shorter than in the spinal cases. The abdominal group comprises chiefly metastases of the liver; these are detected by the presence of large nodular masses.

Perhaps the most interesting observation which the general practi-

¹ Virginia Medical Semi-Monthly, May 24, 1901.

tioner has an opportunity to make is upon those secondary growths in which one sees changes that are almost curative. These changes consist essentially in the conversion of the malignant tissue into a fibrous tissue and to such a degree that the tumors themselves disappear, and, what is still more important, the symptoms they cause disappear. Dr. Osler has had under his observation several cases in which there was undoubted evidence of recurrence, but in which, later on, the secondary tumors entirely disappeared.

Hydatid Disease of the Breast. Le Conte¹ has collected and published in tabular form thirty-three cases of true hydatid disease, including a case coming under his own observation, which he believes to be the first one of its kind in America. His patient was a well-nourished mulatto, aged twenty-seven years, who was admitted to the Pennsylvania Hospital March 13, 1899. She was born in Philadelphia, and had spent her life in that city or in the neighboring one of Camden. Her history was as follows: At sixteen years she was married, and later was the mother of two children, the first born at eighteen years and the second fifteen months later. At twenty-one she had a miscarriage. Shortly after the birth of the first child she noticed an enlargement, with pain, of the right cervical glands, near the angle of the jaw; this enlargement slowly spread down the neck, without suppuration. A little more than four years ago the right axillary glands also became prominent, with slight pain. Shortly after the axillary enlargement, about four years ago, she noticed a tumor, the size of a chestnut, in the right breast, about two inches above the nipple; this tumor was hard, painless, not adherent to the skin, and freely movable. It preserved these characteristics for two years, during which time it did not increase perceptibly in size, until one day she struck it with the handle of a shovel while working. Rapid enlargement then began, and it was at times quite painful, particularly after a hard day's work. The tumor continued firm and hard until one month previous to admission, when it seemed to decrease a little in size and become soft. The right cervical glands suppurated, and were incised six weeks before admission. On admission a round, slightly tender, fluctuating tumor, the size of a small cocoanut, occupied the position of the right breast. The skin was normal in appearance and movable over the tumor, except for about an inch surrounding the nipple, where it was adherent, œdematous, and slightly inflamed. The growth could easily be moved over the pectoral muscle, and but little breast tissue could be made out surrounding the growth. A small mass of tender and enlarged glands was felt in the right axilla. In addition there was a suppurating sinus on the right side of the neck,

¹ American Journal of the Medical Sciences, September, 1901.

which looked tuberculous. The diagnosis was based on the following facts: A hard, painless, freely movable tumor in a young, multiparous mulatto woman, appearing two years after a miscarriage and five years after a chronic enlargement of the right cervical glands. The tumor remained quiescent until subjected to a trauma, when it undergoes rapid growth, but still retains its hardness. The cervical glands break down and suppurate, followed by a softening of the tumor, adhesion to the skin in the region of the nipple, and fluctuation. In discussing the diagnosis three conditions suggested themselves: (1) Adenoma, which had undergone cystic change; (2) tuberculous abscess, and (3) echinococcus cyst. The latter was immediately dismissed on account of its extreme rarity, and also because its clinical symptoms were not known. As the cervical glands were so evidently the seat of tuberculous abscess, the possibility of the breast being the seat of a cold abscess was worthy of consideration; but this diagnosis was also dismissed on account of the long duration of the tumor (four years), its mode of growth, and the absence of sinus formation. A diagnosis was, therefore, made of adenocoele or cystic adenoma, because adenoma is so common in young women, grows slowly and generally painlessly, causes atrophy of the gland from pressure, and sometimes attains large size, even to ten or twelve pounds in weight.

March 15th the patient was etherized and a curved incision made over the tumor to the outer side of the nipple. The sac immediately presented. In attempting to dissect this from the adhesions about the nipple the sac was ruptured, and from twelve to fifteen ounces of pus escaped. Some of this fluid was immediately placed under a microscope, and hydatid hooklets were found in large numbers. As scarcely any glandular tissue of the breast remained, the breast was amputated, together with the enlarged axillary glands. The wound was readily closed with silkworm-gut sutures, without drainage, and healed by primary union. The recovery was uneventful. The pathological notes were kindly furnished by Dr. Simon Flexner:

WALL OF CYST. The inner lining showed to the naked eye superficial convolutions, which, on section of the cyst, presented an appearance of polypoid excrescences. These were in immediate contact with the fibrous tissue, in which there were islands of glandular tissue. Microscopically, the excrescences described consisted of a granulation tissue showing different degrees of density; the outward projections were lighter in texture than the intervening tissues, where the cells were more compact. The character of the cells was largely epithelioid, but among these cells there were a certain number of the type of Unna's plasma cells. At the line of junction between the fibrous tissue and the granulations there was an almost unbroken layer of plasma

cells. The inner surface showed an extensive hyaline transformation of the cells and the intercellular substance. Nothing that could be recognized as such remained of the cuticular membrane. In the forty or fifty sections examined hooklets were not discovered. In the adjacent mammary tissue there was an overgrowth of fibrous tissue.

AXILLARY LYMPH GLAND. Sections of a moderately enlarged lymph gland showed (first) moderate hyperplasia of the lymph cords and (second) extensive hyaline degeneration of the cords and nodes. This latter degeneration affected the interstitial tissue, where it gradually obliterated the lymph cells proper. It also occurred in the walls of the medium-sized bloodvessels. It presented many of the appearances of amyloid degeneration, but it corresponded accurately with Recklinghausen's hyaline degeneration of lymphatic glands. There were no tubercles in the sections.

From the study of those cases which he has tabulated, Le Conte summarizes the conspicuous clinical features of hydatid diseases of the breast in the following words: Hydatid disease of the breast occurs only in women from the age of puberty to the climacteric. It is characterized by the appearance of a small, hard, painless tumor situated in any portion of the glandular tissue of the breast, freely movable with the surrounding breast tissue, either growing slowly or with a more or less long period of inaction. The firmness of the tumor continues until it attains considerable size, and even then the characteristics of a cyst are seldom present. For the most part the growth is smooth and of round or oval shape. Enlargement of the axillary glands, severe pain, irregular outline, and adhesion to the skin are characteristic of inflammation outside of the sac, or degenerative changes in the sac wall, leading ultimately to the death of the organism and a spontaneous cure, either through ulceration or encapsulation. Pain is also associated with rapid growth. The diagnosis will always be extremely difficult, and can never be confirmed until operation or spontaneous opening of the cyst. In the young it will naturally be mistaken for adenoma; in the old, when adherence to the skin and axillary enlargement have taken place, a malignant growth will seem probable. The treatment should always be operative, and may be divided under four headings, according to conditions present: "1. When the cyst is young and not very adherent to the surrounding breast tissue, dissect it out and close the wound without drainage. 2. When the cyst is old and larger, and so intimately connected to the breast that excision would involve a considerable mutilation of the glandular tissue of the mamma, incise the growth freely and evacuate its contents, and then pack or drain, so that granulation may take place from the bottom. 3. When the cyst is quite large, thick-walled, and firmly adherent, but is still surrounded by a

considerable portion of the breast tissue, make a partial amputation of the breast. 4. When the cyst is so large that most of the breast tissue has disappeared through atrophy, or when the nipple is involved and adherent to the growth, a complete amputation of the breast should be done." As for the mortality, no death has been recorded in hydatid diseases even when suppuration has persisted for months after a spontaneous opening. As to the mode of entrance of the parasite into the breast, Le Conte is of the opinion that the eggs must first enter the stomach, in order that their envelope may be digested and the enclosed embryo set free. He fully agrees with Thomas' theory of the causes that influence the seat of hydatids in the body. Thomas says: "It may naturally be supposed that the liver becomes the most frequent seat of these cysts, because the embryos, after finding their way into the portal vein, here meet with the first obstruction to their passage through the capillary system; but many do find passage through it, and, travelling through the inferior vena cava, enter successively the right auricle and ventricle of the heart, and thence by the pulmonary artery reach the pulmonary capillaries, where again a considerable number abide; others run the gauntlet of this second obstruction, and pass by the pulmonary veins into the left side of the heart, and subsequently become conveyed by the current of the systemic circulation to the most remote and varied parts of the body of their host." In unmarried women the embryo finds lodgement in the gland or in the mamma only when the blood-supply of the gland is at its maximum—that is, shortly after puberty; while in a married woman at the time of lactation—that is, when the gland is physiologically in its highest state of development and requiring its maximum of blood.

THORACIC WALL.

Osteomyelitis of the Sternum. The sternum is not infrequently the seat of infection of a chronic type, particularly syphilis; but we very rarely find it the seat of an acute osteomyelitis of staphylococcic or streptococcic origin; according to Koch,¹ but eight cases have been recorded. The disease seems to be a very fatal one, as but three of these cases recovered. Koch's patient, a man aged thirty years, was suddenly attacked with violent epigastric pain, vomiting, high fever, and delirium. The condition was diagnosed as left-sided pneumonia, but in the course of a few days evidences of an active acute inflammation of the bone revealed the true nature of the condition. Operation was for some reason not performed until the fifteenth day, when it was found that

¹ La Tribune Médicale, 1901.

the entire bone was riddled with pus, and that its removal was clearly indicated. The culture was a pure staphylococcus. The patient recovered.

To this series of eight cases must be added one which came under Jochmann's¹ observation. The lesion was only recognized three days before death by the appearance of pulsation over the sternum. The autopsy confirmed the diagnosis and revealed pus in the anterior mediastinum. Evidently the infectious matter travelled in the direction of least resistance, which was toward the mediastinum, otherwise the condition would have been recognized at an earlier date.

Sarcoma of the Sternum. Ambuhrer² records his experience with a series of sarcomata arising from the sternum and from the ribs. In all of the cases save one the pleura was opened, but in none did he note any alarming symptoms resulting from the pneumothorax; in one even a portion of the diaphragm was resected, but this seemed to have no unfavorable effect, so that the author is inclined to believe that involvement of this structure should not constitute a contraindication to the performance of a radical operation. The ultimate results in his series of six cases was anything but encouraging; one recovered, three had recurrence, and two died from infection of the pleural cavity. In looking over the records of some fifty-six operations for removal of tumors from the sternum in which the pleural cavity was opened, he finds that seventeen died shortly after the operation, nineteen remained well as long as they were under observation, and twenty had recurrence.

Sarcoma of the Chest Wall. Two cases of sarcoma of the wall of the thorax requiring an extensive resection have recently come to our notice. One case was reported by Dr. Charles B. Porter,³ in which the growth had invaded not only the seventh, eighth, and ninth ribs, but a portion of the diaphragm as well. That the lungs might be inflated by means of a rubber tube, should sudden shock be induced by collapse of the lung, a preliminary tracheotomy was performed. The growth was then exposed by the reflection of a horseshoe-shaped flap. The capsule presented a greenish-black appearance. On opening the capsule the blood gushed out in alarming quantities and was only checked by pressure. Hemorrhage was so free that it was thought best to remove the entire mass down to the ribs by curettage rather than by dissection. The seventh, eighth, and ninth ribs were divided in the mid-axillary line, and on elevating their ends the lungs could be seen in a partially collapsed condition. The shock which had been anticipated as a result of the collapse of the lung did not occur; there was no cyanosis or

¹ Münchener med. Wochenschrift, September 17, 1901.

² Beiträge zur klin. Chirurgie, Bd. xxx., Heft 3.

³ Annals of Surgery, vol. xxxiv., No. 2.

respiratory distress, although the rate and depth of the respiration had increased. On further exploration it was found that the tumor extended into the pleural cavity, and that the lower pole of this intrathoracic portion was adherent to the diaphragm. That portion of the diaphragm to which the tumor was adherent was removed by an elliptical incision, which was subsequently closed by a shoemaker's stitch of animal tendon. The patient suffered considerably from shock, but reacted well on the following morning. On the second day the respiratory murmur could be heard at the level of the fifth rib, on the third day at the sixth rib in the mid-axillary line, and on the fourteenth day the right lung had reached its full expansion and the respiratory sounds were normal. Sixteen months have now elapsed since the operation was performed, during which time the patient gained thirty-eight pounds and presented no evidence of recurrence. The tumor was a medullary (giant cell) sarcoma of the telangiectatic type, and evidently took its origin from the ribs. The character of the tumor accounted for the free and almost uncontrollable hemorrhage which followed the opening of its capsule.

The case reported by Keen before the American Surgical Association in May, 1901, was a spindle-cell sarcoma involving the fifth, sixth, seventh, and eighth ribs and interposing tissues. The growth was exposed by a large horseshoe-shaped flap and the tumor gradually peeled off the ribs. He adopted this method of procedure for several reasons: First, because there would be less danger of removing an unnecessary amount of the chest wall; secondly, because it enabled him to divide the diseased ribs anteriorly and posteriorly at selected points at a sufficient distance away from the disease before opening the pleural cavity, which would probably cause collapse of the lung; and, thirdly, because after the ribs had been divided he would be able to complete the operation very rapidly, and so diminish the period during which collapse of the lung, especially the initial collapse, would be a threatened danger. He thus describes the concluding steps of the operation: "I found that the fifth, sixth, seventh, and eighth ribs and the tissues between them were all diseased, but that the ninth, tenth, and eleventh were free. I first separated the pleura from the anterior surface of the ribs by a periosteal separator, and by means of bone forceps divided each of these four ribs anteriorly and posteriorly without invading the pleural cavity; then, with a pair of scissors, I rapidly divided the soft parts, including the pleura, and in a moment had removed the entire tumor and made an aperture in the chest wall measuring vertically 18 cm. and horizontally 12 cm. I found that the tumor was just bulging the pleura inward, but had not yet contracted any adhesions with the lung, but soon would have done so. As soon as I opened the pleural cavity

the lung collapsed. Fell's apparatus for artificial respiration was immediately put in use by Dr. Spencer. It was used by means of a face mask which covered the mouth and nose, but was not air-tight. For this reason it did not work satisfactorily, and the collapsed lung was only slightly filled with air; but, fortunately, the patient suffered very little indeed from the practically almost total and immediate exclusion of the right lung from any part in respiration. While I was doing the earlier part of the operation one of my assistants had laid bare a vein at the bend of the elbow in the opposite arm, but without opening the vein, so that he was ready at an instant's notice to proceed to transfusion had it been necessary. As at no time during the operation did the necessity arise, the wound was closed at the end of the operation, and gave no further trouble.

"As soon as I had made the large opening in the chest wall I seized the lung with my hand, drew it up to the opening, and as rapidly as possible, with a long continuous catgut suture, sutured the lung to the edge of the opening throughout its entire circumference. In so doing I passed a curved Hagedorn needle directly through the lung tissue, puncturing it perhaps to the depth of two or three centimetres. As the traction on the upper and lower portions separated the two lobes I sutured these two lobes together at two points, the object of these suturings being to diminish the resulting space for a pneumothorax. The flap was then placed in position, sutured at close intervals, and the wound sealed with iodoform collodion throughout. At the end of the operation the patient was in very good condition."

In spite of the character and length of the operation the patient did not suffer profoundly from shock. At no time after the operation could any evidence of either pneumothorax or pyothorax be demonstrated; very little traumatic pleurisy and no recognizable effusion. Keen calls attention to the points which are worthy of special attention: First, the method of separating the tumor from the chest wall so as to determine more exactly the limits of the disease and lessen the size of the opening to be made in the chest. Secondly, the division of the ribs anteriorly and posteriorly prior to opening the pleural cavity. This diminishes by so much the period of danger in collapse of the lung. Thirdly, the use of Fell's apparatus, which was not satisfactory in this case, and for which he would prefer to substitute the apparatus of Dr. Bloom, of New Orleans, or the apparatus of Dr. Matas. Probably the defective use of Fell's apparatus was due to the mask. Fourthly, the suture of the lung to the chest wall. This was followed by no untoward surgical result. It diminished very greatly the amount of post-operative pneumothorax, and, in fact, one might almost say averted it. Lastly, it is, of course, too early to determine what her future will

be; but up to the present time, a period of nearly seven months, the results have been eminently satisfactory, no recurrence being yet observed.

Cervical Rib. The anomaly of cervical and bicipital ribs and co-existing abnormalities in other portions of the thoracic wall are very frequent, but in very few cases do they give rise to symptoms which either call attention to the presence of the anomaly or require any operative intervention. For convenience of study, cases of cervical rib may be divided into three classes: (1) Those giving rise to no symptoms; (2) those giving rise to symptoms consequent upon nerve irritation, *e. g.*, disturbances of the tactile and thermic sense and pain; and (3) those giving rise to symptoms the result of circulatory disturbance.

Gordon¹ has published a most interesting and instructive report of a case of cervical rib, with obliteration of the arteries of the right arm and with gangrene of a portion of several fingers. The case presented so many points of interest that we venture to quote the history: "The patient, a farm laborer, aged thirty-two years, was in good health until May, 1899. He has never had syphilis, nor is he an alcoholic. His first symptom was the occurrence of attacks of pallor and numbness in the fingers of his right hand when he got up in the mornings. At first the little finger was alone affected, but he afterward noticed it in all the fingers. He suffered from no pain. Early in July his right hand became weak. The weakness passed off after a few days, but the attacks of anæmia and numbness, which had ceased during June, reappeared. Now efforts at working induced symptoms. Near the end of July the hand became red, swollen, cold, and painful. The pain was worse at night, and he used to sleep in a chair, because he had thus less pain than when lying down. The pulse at the wrist ceased to be palpable in probably the latter part of July. He was admitted to the Adelaide Hospital on August 22, 1899. His right hand was then slightly swollen, but did not pit on pressure. The lower third of the forearm and the hand were dusky red and deadly cold. There was what looked like a whitlow on the index finger. No pulse could be felt at the wrist, nor was any pulsation felt in the arm below the junction of the middle and lower thirds of the brachial artery. The artery at the elbow was felt as a cord. On one occasion pressure over the brachial artery caused severe and lasting pain referred to the fingers. The pulse frequency was 110. Strong and visible pulsation was observed in the subclavian artery. It was doubtful if the pulse in the upper part of the brachial artery was less than on the opposite side.

"After a few days in the hospital the tip of the index finger became

¹ British Medical Journal, June 8, 1901.

gangrenous, and gangrene also commenced in the middle and ring fingers. There was neither motor nor sensory paralysis.

"I removed the rib on August 27, 1899. A complete paralysis of the arm followed upon the operation. In spite of this the condition of the hand improved; gangrene of the index and other fingers advanced a little, and then came to a stand-still. The last phalanx of the index was destroyed, but only the tips of the other affected fingers. He was allowed to walk about early in November. When the arm hung down its condition reverted to that at the time of admission; the tip of the little finger became of a slaty-blue color. He no longer suffered from pain, and the effects of the paralysis were slowly disappearing. If the arm were raised up and back the pulse disappeared from the brachial and axillary arteries. It did not return when the arm was lowered until some rotary movements were made."

The cause of the arterial obliteration, which was by no means easy of explanation, is very fully discussed, and brings out some very interesting features in connection with this subject. To begin with, it is reasonable to assume from the results of the operation that the presence of the rib must in some way be held accountable for the circulatory disturbances. Were they due directly to pressure, to thrombosis, or embolism the result of pressure? The answer to each of these questions must be in the negative, for the following reasons: As the circulation in the subclavian was not obstructed pressure could not have produced the symptoms. Were it due to embolism the onset would (as it was not) have been sudden. The manner of the obliteration suggests thrombosis, and it may be that occupation—*e. g.*, the carrying of weights upon the shoulder—may play some part in bringing about the changes in the endothelial coat necessary to the elaboration of this process. Gordon does not believe, however, that the traumatism produced by the carrying of weights could more than render the limb vulnerable to external influences; that "if the rib acted directly on the artery it must have done so in some way upon which present pathology throws no light." There remains, therefore, but one influence which could so affect the artery as to cause its obliteration and the consequent disturbance of nutrition, namely, a nerve lesion. In support of this theory he calls attention to a phenomenon, frequently observed, namely, that when an artery and nerve are equally exposed to pressure the nerve is more likely to suffer than the artery, and as a result nervous symptoms are more common than circulatory. Crutch palsy is a very common example of this. The relations of the brachial plexus to the cervical rib are so intimate not only at its anterior, but at its vertebral end, that we can readily understand how the presence of such an anomaly would give rise to nervous symptoms. We know, furthermore, from clinical observations

that nutritional disturbances—*e. g.*, gangrene— may be the direct result of a nerve lesion, as a peripheral neuritis, acting upon the vessels of the affected part. These disturbances of nutrition may be the result of pathological alterations in the vessel wall, obliterating in character, or the result of the action of the vasomotors upon the vessel wall through the action of the sympathetic. The question finally seemed to resolve itself, therefore, into whether the disturbances in the circulation were due to lesions of the peripheral nerves (in this case, the brachial plexus), or to injury of the sympathetic system (in this case, the cervical sympathetic). In Gordon's case there was no evidence of a peripheral neuritis, so that he was forced to conclude that injury to the cervical sympathetic must be regarded as the most likely explanation. In order to further support this theory he made a very careful dissection of the relation and connections of the cervical sympathetic and the brachial plexus, the results of which are as follows: Normally, the eighth cervical and first dorsal nerves unite above the first rib, the last-named nerve rising to meet the other in intimate relationship with the neck of the rib. The neck of a cervical rib is crossed by the conjoined roots of the same nerves, and the seventh cervical nerve is a superior relation to the rib. I believe it is here—that is, at the neck of the cervical rib—that pressure symptoms are most likely to be produced. Since the cervical and first thoracic rib converge anteriorly, it is obvious that the displacement of normal relations will be greater the nearer the approach to the vertebral end. (It follows that the artery, which is only related to the cervical rib at its anterior end, will suffer relatively less displacement than the nerves.) The inferior cervical ganglion of the sympathetic lies normally in a recess occupied by loose fat between the head of the first rib and the transverse process of the seventh vertebra. In the presence of a cervical rib it will very probably be dislodged from this recess and lie in the much less protected position in front of the head of the abnormal rib. The branches of the ganglion to the nerve trunks are most abundant, as they concern the lower brachial nerves; that is, the nerves most endangered by the cervical rib. The branch to the seventh nerve normally passes through the foramen in the transverse process of the seventh vertebra. This connection must be completely altered in the presence of a cervical rib, but I have no knowledge of what its course actually is under such circumstances.

From these anatomical studies it is possible to understand how the extra rib might produce its harmful effect rather at its vertebral than at its distal extremity, and, if this is so, it becomes easier to explain the singling out of vasomotor fibres than if the rib only acted at its anterior end.

If we accept the "sympathetic" theory we can readily explain some

of those rarer symptoms which occur in connection with cervical ribs, as, for example, increased heart action; excessive subclavian pulsation and sometimes fusiform dilatation of the artery; abnormal sensitiveness of the arm affected to external cold; and, lastly, thyroid enlargement.

AIR-PASSAGES.

Foreign Bodies in the Air-passages. De Forest Willard¹ presents in a very thorough manner the question of the treatment of foreign bodies in the air-passages. As the majority of these accidents occur in children, it is important that the parent be instructed as to the procedures which should be adopted before professional assistance is at hand. Inversion of the child is probably the safest domestic practice that can be instituted, and may prevent the object from being sucked still lower in the bronchus. An exaggerated Trendelenburg position may be maintained until the surgeon arrives, and coughing should be encouraged; but the violence of inspiratory movements should be restricted as far as possible. Upon the arrival of the surgeon the subsequent care of the case will depend upon the seat of the foreign body. If the latter has been arrested at the vocal cords it may be extracted by the forceps or by a laryngotomy; if operation be necessary care should be taken to cocaineize the mucous membrane both before and during operation, to prevent reflex inhibitory shock. Localization of the foreign body is a simple matter if it is lodged in the larynx. If it has passed beyond the point at which it may be seen with the laryngoscope its presence may be determined by the X-ray and its exact site determined by making radiographs at different angles. It is most important that the child be motionless while the exposure to the Röntgen ray is being made, and to this end a general anæsthetic must be administered.

Before any plan of treatment is undertaken one should try to confirm the history and make sure that a foreign body has become lodged in the respiratory tract. Statistics show that in by far the majority of cases which apply for removal of foreign bodies from the throat no foreign body has been found. Thus in Juaraz's clinic in Heidelberg, of 106 who applied for the removal of foreign bodies from the throat in only four was a foreign body found. The presence of a foreign body may be detected by the laryngoscope if it be in the larynx, or by the bronchoscope if it be in the bronchus, and if it be impenetrable to the X-ray, by the radiograph. In addition to these methods of detection there are certain physical signs which are of assistance in confirming

¹ Journal of the American Medical Association, October 26, 1901.

the diagnosis—thus, pain and absence of respiratory movement on one side of the chest, the absence of vesicular movements, with dulness and signs of consolidation, and, in partial occlusion, stridulous respiration. The symptoms, which are most alarming at first, may abate somewhat, and thus deceive the attending surgeon. Given a case in which the object is not accessible to the laryngeal forceps, the most frequent method adopted for reaching it is by opening the trachea. Local anæsthesia is preferable to general anæsthesia, in order to retain the extraordinary muscles of respiration. Willard advises the removal of at least one or two tracheal rings rather than the making of a longitudinal slit. If, as frequently happens—probably in one-half the cases—the body is not ejected by the primary cough induced by the operation, the subsequent course will depend upon the seat and upon the nature of the object to be removed. This was the fortunate issue in a case reported by Diehl.¹ His patient was compelled to wear a tracheotomy-tube permanently; the protecting flange broke off and slipped down into the left bronchus. Failing to effect removal by instrumental means, another tracheotomy was decided upon, when the patient unexpectedly coughed up the foreign object.

The trachea and bronchus may be explored with forceps, and the seat of the body determined in that way; but in some instances the character, particularly the consistency, of the object may be such as to make this either difficult or impossible. A bean or a kernel may feel very much like the cartilage at the bifurcation of the trachea. In these as in other cases a view of the foreign body may be procured with the cystoscope (Willard) or by the use of Killian's bronchoscope. In this connection we might mention a case in which the attempt to remove the foreign body from the left bronchus by Killian's method was unsuccessful.² The case was unusually difficult because the foreign body, a collar button, had been *in situ* four years. The patient had suffered considerably as a result of the inflammatory condition excited by the button. The button was located with the bronchoscope without any difficulty, but all attempts at removal by instrumentation failed, because the perforation in the bronchial wall through which the button had passed had become too small. Ingenious methods were devised to dilate the orifice and secure the button, but these proved ineffectual, and the patient succumbed several months after to the effects of the lung lesion. Spiess was so struck with the ease with which the object could be seen through the bronchoscope, and the comparative ease with which it could be manipulated with instruments, that he was convinced that this method should be tried in all similar cases.

¹ Münchener med. Wochenschrift, March 26 and April 2, 1901.

² Spiess. Münchener med. Wochenschrift, March 26 and April 2, 1901.

Once the seat and character of the object has been determined, its removal may be effected in a variety of ways; but whatever be the method selected, the operator should bear in mind that prolonged instrumentation greatly adds to the danger. It has been estimated by Weist, in an analysis of 1674 cases, that the dangers of death from this cause in unsuccessful cases is fully counterbalanced by the number of extractions by tracheotomy. The proportions are one death in three and a half cases without operation; one in four with tracheotomy. Willard, in commenting upon these statements, says that the conclusions of Weist "will probably not be materially changed by our present methods, since, although the pneumonia is septic in its origin, yet the sepsis even in former cases was not due in large measure to the instruments, but to the traumatism to the bronchi, since experiments show that the entering of air is septic in the larger bronchi, but aseptic in the smaller divisions." Failing to remove the foreign body with forceps, blunt hooks, scoops or loops may be tried, trying one or the other, according to the size and shape of the object. Willard suggests the employment of suction by attaching a Bigelow litholapaxy evacuator, or an aspirating pump, to a large soft rubber tube.

In the case of such objects as tacks or nails the magnet or electrical probe has proved successful. J. Garel¹ was called to see a child who, two months previously, had swallowed a nail. The radiograph revealed a long nail lying obliquely in the thorax, in the direction of the right bronchus, the point below and the head above. A tracheotomy was performed under ether anæsthesia. Before making any attempt to remove the nail with forceps an electromagnet was brought near the open wound, and the nail jumped quickly from its place and clung closely to the magnet. The child made a perfect recovery.

Milton² performed what he terms an intrathoracic tracheotomy by carrying out his method of exposing structures which are situated posterior to the sternum. (We have already had occasion to refer to Milton's method in speaking of ligation of the innominate artery.) After dividing the sternum longitudinally its two halves were well retracted and an incision made in the air-passage just above the bifurcation. The foreign body, which in this case was the canula of a tracheotomy-tube that had accidentally slipped down into the bronchus, was easily removed. The patient reacted well, but developed acute sepsis and died within a few days. In order to prevent infection in future cases Milton would resect a portion of the sternum, so that he could tampon the brachial wound.

In a certain proportion of cases the attempts to extract objects through the trachea will result in failure. There remains then but two alternatives—abandonment of the case to nature or the exposure of the

¹ *Lyon Médicale*, January 6, 1901.

² *Lancet*, January 26, 1901.

bronchus by the direct route. The selection of one or the other of these plans should depend upon the amount of obstruction and upon the character of the foreign body. When the foreign body has been a seed, voluntary expulsion, with subsequent recovery, has taken place in 74 per cent.

If the radical method be selected the surgeon has undertaken a task which will tax to the utmost his skill and judgment. The difficulties that attend the operation are very forcibly described by Willard. "When an opening of any considerable size is made in the pleura, and air rushes in, the sudden symptoms of collapse are usually instantaneous. The sudden shifting of the oxygenation of air upon one-half the ordinary circuit; the violent efforts of both respiration and expiration; the enormous movement of the lung in the effort to produce a vacuum in the chest; the flapping of the pleura and mediastinum; the huge, swelling veins filling and emptying and covering the area of operation; the great peril of the patient; the cyanosis and deficient oxygenation—are such complications as will greatly delay and often entirely prevent all safe manipulative measures." Not only are the symptoms alarming and the bronchus difficult to reach, but even when the bronchus has been exposed its rigid walls may prevent recognition by sight or touch. Practice upon the cadaver, Willard says, yields but a slight realization of the conditions found in the living subject. He has at autopsy seen the bronchus of a dog apparently within easy reach, and had seen the same bronchus ten minutes before surrounded by huge pulmonary and azygos veins, with aorta, pneumogastric nerve, root of lung, and every structure in the neighborhood being violently dragged by the wide excursions of the lung in the frightful air hunger of the collapse from acute pneumothorax.

The bronchus may be approached either by the anterior or posterior route; but whichever be selected, the assistance of an apparatus for artificial respiration is absolutely necessary. Matas' apparatus will be found superior to the Fell-O'Dwyer.

The tube must be introduced through a tracheotomy wound and a pressure of 6 mm. employed. (Too high pressure—*e. g.*, 33 mm.—will interfere with respiration.)

Anterior thoracotomy may be carried out by Milton's method or by reflecting a trap-door flap, including the third, fourth, fifth, and sixth ribs, with its base at the costal cartilages, as recommended by Gaston. Willard has tried various forms of incision; he found that the bronchus of the right upper lobe was easily exposed by an excision of the fifth rib. He pushed aside the bronchial, pulmonary, and a very high azygos vein and incised the bronchus for a third of an inch without wounding any of the surrounding structures. Posterior thoracotomy

may be performed by the methods of Bryant and others. The following is a description of Bryant's: "In order to give room for the flap the scapula is carried far outward by raising the arm and carrying the shoulder forward. A square flap three inches in size is made, with its base toward the spinal column, and three ribs—the third, fourth, and fifth—are sawed through as far out as their angles, near the posterior border of the axilla. The pleura is then separated from the anterior surface of the ribs by the fingers, and the flap is turned backward upon its base as a hinge, the ribs being separately turned out. The intercostal arteries were ligated before opening the pleura. The presence of the vena azygos and the pulmonary vein will greatly interfere with manipulations, and these, as well as the pneumogastric nerve, must be carefully avoided. If the foreign body can be located, a long incision (long enough to permit removal without laceration) is made in the bronchus. The bronchus is not closed, but packed and drained, as there will be a discharge of mucous and inflammatory products. The flap with the ribs should be replaced, but the middle rib may be removed entirely for drainage, if advisable. Any given spinous process indicates the situation of the vertebral extremity of the rib immediately below. Bryant places the division line between the posterior mediastinum proper and the posterior part of the superior mediastinum at the lower portion of the fourth dorsal vertebra. The separation of the pleura is accomplished with the finger, and also by a sawing motion of a strong silk thread carried beneath the rib. The same ligature may be used to draw beneath the rib a chain saw, so as to operate from within outward and avoid premature wounding of the pleura." Curtis attempted to remove a foreign body supposed to be lodged in the bronchus by reflecting a quadrangular flap from the posterior wall of the chest, including the fourth, fifth, and sixth ribs, with its base toward the scapula. After carefully detaching the pleuræ from the posterior mediastinum and chest wall the bronchus was easily reached. The azygos vein covered it so as to prevent incision at once. The wound was packed, and on the following day a second attempt was made. Meanwhile the pleura had become adherent to the lung, and as a consequence there was less violent action of the lung and less flapping of the pleura, making it possible to open the bronchus without hemorrhage. The object was not in the bronchus, but was found later in the lung substance, and an attempt made to reach it by incising the lung with a thermocautery knife. The shock was so severe that further intervention had to be stopped. The patient died forty-eight hours later of pneumonia.

If gangrene or abscess develop as a result of the lodgement of a foreign object in the lung the condition should be treated by incision and drain-

age. In exceptional cases the abscess will evacuate itself spontaneously, but more frequently death ensues.

Willard, from whose article we have quoted so freely, draws the following conclusions appertaining to the treatment of foreign bodies in the lung: 1. Coughing should be encouraged, forcible inspiration restrained. 2. Inversion in the prone position as a domestic practice is advisable. 3. Laryngoscopy is helpful if the body is lodged at the vocal cords; it may be extracted by forceps or by laryngotomy. 4. If time permits the X-ray may be brought into serviceable use for diagnosis. 5. Careful diagnostic investigation is important to determine the actual presence of an impacted body and its location. 6. Tracheotomy under local anæsthesia should be the rule if the object is lodged at the bifurcation or in the bronchi. Tracheoscopy, suction, and forceps manipulation must be cautiously employed. Prolonged instrumentation adds greatly to the danger of pneumonia. 7. If extraction is not secured through the tracheotomy wound the chest wall should not be invaded unless an artificial respiratory apparatus like the Fell-O'Dwyer is at hand and oxygen available. With the assistance of these appliances, however, the bronchus may be reached, anteriorly or posteriorly, since by their use rhythmical movements can be maintained. 8. Resultant abscess of the lung should be treated by incision and drainage.

THE PLEURA.

Empyema. The subject of the surgical aspects of empyema was exhaustively treated in the March, 1901, number of *PROGRESSIVE MEDICINE*, and since that time there have appeared but few articles which have attracted the attention of the surgical world. The most important is a paper which Fowler,¹ of New York, presented to the Section of Surgery and Anatomy of the American Medical Association at its last annual meeting—an article entitled “Decortication of the Lung for Chronic Empyema.” Decortication of the lung is defined by Fowler as a procedure intended to relieve the lung from its environment in cases in which expansion is prevented or interfered with by the presence of a greatly thickened pleural covering. This plan of treating chronic empyema seems to have originated in the minds of two men simultaneously, and this, of course, has given rise to a dispute as to priority. The idea seems to have occurred to Delorme in 1893, and at that time he made some experiments upon dogs, the results of which were not reported in such a way as to obtain wide circulation. On

¹ *Medical News*, June 15, 1901.

October 7, 1893, Fowler, wholly unaware that Delorme had, on April 3, 1893, reported before the *Congrès Française de Chirurgie* some experiments upon the cadaver, with a view toward determining the feasibility of such an operation, performed the operation upon the living subject, with excellent results. As far as the originality of the idea goes, both seem deserving of equal credit; as far as priority in practically demonstrating the feasibility of the idea goes, this unquestionably belongs to Fowler. As a matter of historical interest we publish a short abstract of Fowler's first case: "The patient, a female, aged thirty-five years, was admitted to my service at the Methodist Episcopal Hospital with a history of having suffered from an intractable chronic empyema of the right side following an attack of grip nearly two years previously. Examination showed a sinus with a depressed external opening, lined with integumentary tissue, leading directly forward from the interspace between the fifth and sixth ribs in the axillary line for the distance of about five inches, at which point it terminated in a small cavity. This sinus was the site of a tube drainage which had been instituted two years previously. Many attempts had been made during this time to dispense with this tube, but without success, this invariably leading to reaccumulation of the purulent fluid and an accession of febrile symptoms. The previous history of the case showed that many attempts had been made to effect obliteration of the cavity and closure of the sinus, including persistent antiseptic irrigation, curetting, and stimulating injections, but without result. The physical signs showed that the lung was retracted to the costopulmonary angle above the third rib, the left lung doing practically all the work, with consequent dyspnoea upon exertion.

"On October 7th an elliptical-shaped incision was made to include the orifice of the sinus, the soft parts cleared, and about three and a half inches each of the fifth and sixth ribs removed. The greatly thickened costal pleura was then revealed firmly attached to the chest wall, and through which the sinus passed in the direction of the median line of the body. Commencing at the site of the opening in the chest wall, the pleura was isolated by blunt dissection in the direction of the diaphragm until the latter was reached. It was then peeled off from the latter until its limit toward the median line was reached, where it was found to rest against the displaced pericardium, from which, after much difficulty, it was finally detached. This dissection was greatly impeded by the movements of the diaphragm as well as those of the heart. The dissection was completed by lifting the mass and finally detaching it from the lung above. Considerable expansion of the lung followed at once, and in the course of twenty-eight days this was so far complete that the normal vesicular murmur was present to the level of

the seventh rib. The heart had so far receded that its apex-beat appeared well to the left of the sternum. This patient is still living and apparently in the best of health. Save for a slight sinking in of the chest wall at the site of the resection of the ribs there is nothing to suggest the previous existence of an empyema."

The indications for the performance of this operation are twofold : one to remove the thickened and degenerated pleura, in order to ensure early obliteration of the cavity, and the other to restore the function of the lung by releasing it from the adherent pleura. The latter of these indications is the one easier of accomplishment, as it may require only a visceral pleurotomy, with more or less detachment of the adherent and thickened pulmonary membrane. The former indication requires a more radical operation, which should consist in a complete visceral pleurectomy—that is to say, one combining a visceral, costal, and diaphragmatic pleurectomy. While the latter will always bring about the best results, it should be stated that a rapid and complete recovery has followed the less radical operation. In every case in which the complete visceral pleurectomy was indubitably performed the results were perfect, while in those instances in which, for various reasons, the operation stopped short of removal of the entire pleura four failed to obtain complete expansion and one had an unhealed fistulous tract.

THE INDICATIONS FOR DECORTICATION of the lung are clear and well defined, but whether or not a case is one in which the operation is feasible or practicable cannot be positively determined before the chest is opened and the affected parts explored. As to this point, Delorme, in a paper presented to the Fourteenth Congrès Française de Chirurgie, held in October, 1901, referred to the researches of the Belgian surgeon, Gallet. The latter claims that by the use of the radiograph one can determine beforehand the cases in which pulmonary decortication is likely to be successful and those in which it offers but little chance of ultimate recovery. He found when the lung had been the seat of a pleuropneumonia, and was not dilatable, that the radiograph revealed a uniformly opaque shadow, in which the outline of the ribs was not discernible. When, on the contrary, the lung is healthy and capable of dilatation, the outlines of the ribs were clearly depicted. Gallet demonstrated on the living subject the value and reliability of this test. The radiograph revealed, according to his interpretation, a lung sclerosed and incapable of expansion, and subsequent operation confirmed this opinion. In another case the reverse was true ; decortication was practised, and recovery ensued. These researches are still in their infancy ; but, as Delorme says, they are capable of further development, and will undoubtedly furnish us information that will be of great value. Had it been possible in the past to eliminate the unsuit-

able cases, the number of reported failures would be very materially reduced. Clinical signs and bacteriological examinations unfortunately furnish us nothing that can be of service in the selection of the suitable from the unsuitable cases. If after the operation has been begun we find it impossible or impracticable to detach the pleura, we must abandon decortication and proceed to perform Schede's operation.

There seems to be but one contraindication peculiar to this particular operation, namely, tuberculosis. If upon examination of the thoracic organs there are found evidences of tuberculosis, these, if sufficiently extensive, should deter the operator from attempting this operation. When we come to look at the results we will find that tuberculosis was responsible for all the deaths, for at least half of the failures to cure, and a majority of the failures to restore the function of the lung.

METHOD OF OPERATING. The special points in the technique of the operation to which Fowler calls attention are as follows: "Ample access to the pleural cavity is to be secured by turning a flap of the soft parts so as to expose two or more of the ribs. The size and shape of this flap will be governed by the position and dimensions of the cavity and the relations of the lung to the thoracic wall. If a fistula exists, at least one and if possible two ribs above this point should be resected. The method of anterior thoracotomy through the cartilages, advocated by Veslin, does not seem to possess any particular advantages. Immediately upon opening the pleural cavity, rapid curettage, accompanied by irrigation by means of boric acid or potassium permanganate solution, should be done. The suggestion of Lambotte to inflate the lung during the operation under general anæsthesia is scarcely practicable, although if this is deemed desirable the patient may be permitted to come out from under the influence of the anæsthetic sufficiently to cough. If spinal cocainization is used, as in my second case, the patient may be directed to inflate the lungs at will. Excessive hemorrhage must be kept in check and unnecessary dissection avoided. In incising the visceral pleura, at which point the pleurectomy is generally commenced, care should be exercised not to injure the lung. A small incision to ascertain the thickness of the pleura should first be made, and this subsequently enlarged upon a grooved director. The lung may be recognized by its gray color, and every care should be exercised to avoid penetrating this in the subsequent steps of the decortication. If the lung shows a marked tendency to become herniated at the site of the first incision to an extent to embarrass further manipulation, a second opening may be made, and the decortication carried on from this point instead of enlarging the first. After the incision is once made and the peeling-off process commenced, the fingers of the operator and a pair of blunt scissors are alone needed to complete the decortication.

The bleeding is held in check by crowding gauze behind the blunt scissors, or the fingers of the operator if these are used. By following up the track of the scissors or fingers in this manner surprisingly little blood will be lost. In cases uncomplicated by tuberculous deposits, and particularly where a fistulous track exists passing through a mass of cicatricial tissue and degenerated pleural membrane, the operator may be encouraged to attempt a complete removal of the latter. The operation may be completed by a light tamponade with gauze and suture of the flap in part. As a part of the after-treatment the patient should be taught to encourage complete expansion of the lung by the use of an apparatus consisting of two large bottles connected together by an inverted U-shaped tube reaching to the bottom of each bottle. Another tube leads into each bottle, through which the patient forces air upon the surface of the water with which the bottle is filled, thus driving the water from one bottle to the other, and *vice versa*."

In a case operated upon by Fowler in May, 1901, he felt obliged to use spinal anaesthesia, inasmuch as the condition of the patient would not permit of the use of a general anaesthetic for the length of time which would probably be required for so extensive an operation. The patient had a mitral insufficiency, a high grade of cardiac dilatation, a high leucocytosis, and a low hæmoglobin percentage. Not being able to keep the patient quiet long enough for spinal puncture, local anaesthesia with the inhalation of a few whiffs of chloroform were resorted to. Under the influence of the latter one grain of cocaine, sterilized with chloroform and dissolved in forty minims of sterilized water, was injected into the spinal canal and immediately the head of the table lowered to facilitate the passage of the cocaine solution to the upper portion of the canal. The effects were pronounced. In a few minutes the entire body below the level of the clavicle was absolutely insensitive to pain, and remained so until the time of the application of the sutures—a period of an hour and a quarter.

RESULTS OF DECORTICATION. Since the time of Fowler's first report the operation of decortication, either by visceral pleurectomy, combined visceral costal and diaphragmatic pleurectomy, or visceral pleurotomy with detachment, has been attempted or actually performed forty-one times. Fowler has found it difficult to estimate the actual results, so far as restoration of function is concerned, for the reason that in reporting cases operators seem to lay more stress upon the operation than upon the functional results. From a study of thirty cases in which the data was sufficiently full on these points the following are the results :

1. Viewed from the stand-point of recovery, with complete restoration of function of the lung :

Cured	11
Improved	6
Unimproved	9
Died	3
In doubt (my second case)	1

2. Viewed from the stand-point of cure of the empyema, the following is shown :

Cured	17
Unimproved	9
Died	3
In doubt	1

3. If we deduct the six cases of advanced tuberculosis from the total number, and consider the subject from the stand-point of cure of the empyema, the following appears :

Cured	17
Unimproved	5
Died	1
In doubt	1

4. Separating the cases of visceral pleurectomy and visceral pleurotomy with detachment, from those in which the diseased portion of the pleura was removed *in toto*, the following appears :

Visceral pleuotomy and pleurotomy, with detachment of the visceral layer (excepting cases of advanced tuberculosis), 22 cases.

Empyema cured	16
Empyema not cured	2
Operations abandoned	2
Died	2

Total pleurectomy (excision of all accessible diseased visceral and parietal pleural membranes), 2 cases (both my own) :

Completely cured	1
In doubt	1
Died	0

5. Again, separating the cases of typical visceral pleurectomy from those in which, so far as can be gathered from the reports, the visceral pleura was simply split or incised and the edges of the incision separated so as to permit expansion of the lung, it is found that 7 recovered, so far as the empyema was concerned, but only 3 had a complete functional result, and 1 died. If we excluded from this list the fatal case of Reclus, in which the autopsy showed extensive tuberculosis of both lungs, and respecting which Reclus states that the operation should not have been attempted, the showing is much better. On the other hand, taking the cases in which pleurotomy, with detachment only of the visceral pleura (no portion of the membrane being removed, so far as could be ascertained), and including the cases of advanced tuberculosis,

it would appear that 5 were completely cured, 4 were improved, 11 were unimproved, and 2 died. Eliminating the tuberculous cases (those in which well-marked evidences of tuberculous deposits were apparent at the operation or revealed by the autopsy), as well as those in which, after incising the costal pleura, it was found that the visceral pleura was not sufficiently accessible to warrant an attempt to incise it (2 cases), it was found that 5 were completely cured, 4 were improved, 5 were unimproved, and none died. Of the 4 improved cases all had incomplete but improved expansion of the lung, but one of them had a persistent fistula.

In summing up the results in this series of 30 cases we find, first, that, as regards functional results, there have been 11 cures and 3 deaths, the remainder being improved, unimproved, or doubtful; secondly, as regards cure of the empyema, that there were 17 cures, 1 death, 5 unimproved, and 1 doubtful. Inasmuch as pulmonary tuberculosis is regarded as a contraindication, we can exclude 6 cases which were subjects of advanced tuberculosis, so that the final percentage of cures, deaths, etc., would be as follows :

Recovery with restoration of function	46 per cent.
Cured of empyema	70 "
Deaths	4 "

These results are such as will command the attention of all those interested in the treatment of empyema, and I have no doubt but that the operation will receive universal indorsement. As compared with the results of other methods heretofore practised, particularly Schede's, the ultimate results of Fowler's operation are most encouraging. The necessary disfigurement and deformity attending Schede's operation is of itself a very serious disadvantage, not to speak of the percentage of failures to cure the empyema and failures to restore the function of the lung; but, for want of a better operation, surgeons have been forced to turn to it when the less radical operation of Estlander failed to achieve the desired result. In the management of empyemic cavities the surgeon should in all cases first give Estlander's operation a fair trial, reserving Fowler's method for those cases which have proven intractable to less radical procedures. The following are Fowler's conclusions :

1. Decortication of the lung is an operation adapted to all cases of old empyema in which extensive and pre-operatively discoverable tuberculous lesions of the lungs are not present, and in which the patient's condition will permit of a major operation. 2. It may be advantageously substituted for Estlander's operation in the majority of instances in which the latter has been considered, up to the present time, as being indicated, since it is more a rational procedure in that it com-

bines the advantages of restoration of function of the lung, so far as this is possible, with closure of the empyemic cavity. 3. It should replace Schede's operation in all cases. 4. The method by extirpation of the diseased portion of the pleural membrane, including the visceral, cortical, and diaphragmatic portions, is the operation of choice. 5. Failing this, visceral pleurectomy should be selected. 6. Pleurotomy, with simple detachment of the visceral layer of the diseased pleural membrane, gives sufficiently good results to warrant the surgeon in resorting to this procedure in cases in which the condition of the patient will not permit of the application of the other and more desirable methods. 7. Whatever operative method is adopted, as complete access to the cavity of the chest as possible should be obtained, and rapid closure of the opening in the chest wall afterward secured, since the complete re-expansion of the lung must depend largely upon the normal respiratory movements. 8. Pulmonary or respiratory exercises should not be neglected in the after-treatment, since these aid greatly in the restoration of the function of the lung.

OTHER METHODS OF TREATING EMPYEMA. In a paper read at the annual meeting of the American Medical Association,¹ Dunn discusses the various views of the subject concerned in the treatment of empyema. He believes that bacterial diagnosis of the variety of the infection is exceedingly desirable as influencing the subsequent treatment. In the average case of acute empyema the normal procedure of treatment should consist in a thoracotomy, with resection of about 6 cm. of a rib—a space sufficient to admit of the introduction of two or three fingers. But three exceptions to this normal procedure in the treatment of acute empyema should be made: (1) Pure pneumococcic pleurisies, in which thoracentesis should be tried, as it not infrequently succeeds in effecting a cure; (2) certain pure tuberculous pleurisies, in which the exudate is apparently sterile or in which there is little rise of temperature or evidence of sepsis; (3) cases of large double effusion, in which gradual evacuation by paracentesis is advisable as a preliminary measure; or cases of double empyema, in which the rib resection may be made on one side and the siphon drainage of Bülow may be simultaneously instituted on the other. Dunn prefers in most cases brief and light chloroform narcosis, but if there should be any contraindication to chloroform, the operation can be performed with little discomfort under local anæsthesia. Ether should not be used. As to the point at which to place the opening into the cavity, it may be laid down as a general rule that it is best to place the opening moderately low and well posteriorly. According to Dunn, lavage or resection has

¹ Journal of the American Medical Association, October 26, 1901.

a very limited field of usefulness. It should be reserved for those cases in which there is either an abundant purulent or fetid secretion or in those cases in which fever persists or reappears after a period of apyrexia. If lavage be instituted it is important that it should be carried out in a gentle manner, as serious accidents have followed disregard of this precaution. For the purpose of keeping the wound open and its lips in a good, healthy condition, copious gauze drainage is preferable in most cases, at least in the early after-treatment. There are certain instances in which rubber drainage should be substituted, as, for example, when the secretion is very great or very thick and tenacious; but tubular drainage has the objection of encouraging the wound to close down rapidly, so that command over the cavity by direct inspection is lost, and, furthermore, exercises a bad influence over the soft tissues. The ingeniously devised drainage-tubes, valvular and otherwise, are absolutely superfluous. The after-treatment of these cases should be directed in such a way as to prevent reinfection of the empyemic cavity. Not only should general attention be directed to the constitution and the care of the wound, but every effort should be made to favor expansion of the lungs by the use of some form of pulmonary gymnastics. The suggestion of Koenig, requiring such patients to blow up air-pillows several times daily, is practical and efficacious.

Drainage in the Treatment of Empyema. Of all the principles involved in the treatment of empyemata, perfect drainage is the most important. After an opening, sufficiently large and properly situated, has been made, the after-treatment with most surgeons consists in attention to the patient's general condition and in the daily dressing of the wound, with or without drainage, until the cavity becomes obliterated. In the Leipzig clinic they have employed since 1897 a suction apparatus, known as Bunsen's water pump, with a view toward obtaining as far as possible a vacuum, thereby favoring expansion of the lung, and, as a consequence, obliteration of the empyemic cavity. The apparatus is applied immediately after the pleural cavity has been opened, and is not removed until the expansion of the lung is complete.

Perthes¹ reviews the results which have been obtained since the institution of this mode of treatment. The results depend not only upon the nature of the after-treatment, but upon the character of the infection. The prognosis is very much better in cases of pneumococcic than in cases of streptococcic infection. For purposes of study the cases were divided into three groups: the first, recent uncomplicated cases; the second, old or long-standing cases; and the third, cases complicated with gangrene, tuberculosis of the lung, and subphrenic abscess. Group

¹ Mitt. a. d. Grenz. d. Med. u. Chir., Bd. xii., Heft 4 u. 5.

I. included 12 cases which had submitted to operation within the first six weeks. All terminated in recovery, the average duration of treatment being fifty-eight days; in 6 cases of pneumococcic infection the average duration of treatment was forty-eight days and in 4 of streptococcic infection the average was seventy-eight days. Not one of the cases was complicated by fistula formation requiring thoracotomy; 6 cases recovered without any deformity of the chest, in 3 there was a difference of from 1 to $1\frac{1}{2}$ cm. between the sound and healthy side as measured by the cystometer, and in 3 a considerable difference between the two sides. In chronic empyema the indications for treatment depend: 1. Upon the size of the cavity. This is best determined by putting the patient in such a position that the drainage opening is at the highest point and allowing a solution to run in from a graduated vessel. 2. The position and extent of the cavity, as determined by auscultation, percussion, and the use of the X-ray. In order to derive the most information from the radiograph a rubber tube was filled with quicksilver and introduced into the cavity. The radiograph will demonstrate the limitations or extent of the cavity by the space occupied by the rubber tube, the definition of which is very sharp. 3. The expansibility of the lung. This may be determined by the use of Valsalva's method, or by the following method, which is easier of application and more accurate: The capacity of the cavity is first estimated in the manner above described. With the aid of suitable apparatus, measurement is made of the number of cubic centimetres of air which can be aspirated. Knowing the capacity of the cavity, the expansibility of the lung can be calculated by deducting the quantity of air aspirated. 4. The presence or absence of a communication between the empyema and the bronchi. The former constitutes a positive contraindication to the use of the treatment under discussion. Of 11 cases in Group II. 5 were cured; of the remainder there was a considerable diminution in the size of the cavity, and in one a resection or thoracotomy was necessary to effect a cure. Two cases were excluded as being unsuited or ill-adapted to treatment by aspiration. Group III. comprised 3 cases with pulmonary abscess, of which 1 recovered and 2 died (the aspirator was not used in these cases); 7 with a pulmonary fistula, of which 1 was unimproved and 6 recovered; there were 3 cases complicated by subphrenic abscess, all of which recovered. It is claimed for this treatment by aspiration that it not only shortens the period of convalescence, but effects a cure in many cases which would otherwise have required a more radical operation.

THE LUNG.

Surgical Treatment of Cavities in Tuberculosis. The pulmonary lesions, the treatment of which has fallen within the scope of the surgeon, now include tuberculosis or phthisis, abscess cavities, bronchiectasis, and gangrene. Of these tuberculosis at once strikes us as deserving of the most consideration, since it is charged with the deaths of many thousands of people annually. In the *Centralblatt f. d. Grenzgeb.*, November 26th, Alfred Beriner has published a very complete and instructive review of the operative treatment of tuberculosis of the lung, with particular reference to pulmonary cavities. His review is based upon a study of some thirty-five articles upon this subject which have been published since 1895. As far back as 1873 Mosler conducted a series of experiments on animals to determine the effect of the parenchymatous injection of antiseptics, and later studied the effect of laying open tuberculous cavities and irrigating them with salicylic and carbolic acid. But it was not until 1896 that Quinke proved it possible to cure tubercular cavities by surgical measures, and demonstrated to all that this could be attained only by removing the upper portion of the thorax; by this he meant not the excision of a single rib, but an extensive osteoplastic rib resection. Spengler and Turban have operated according to this method, and from their results it appears as though by Quinke's method we have come nearest attaining the desired end. From patient study during the last two decades it has become very evident that the chief difficulty in curing these cases lies not so much in difficulties of technique as in the selection of suitable cases. Sarfert has estimated that perhaps in one hundred cases there is but one suitable for operative intervention, and yet we should not be discouraged by this small percentage, when we know that in Germany alone about a quarter of a million of people die annually from consumption.

The cases suitable for operation include only those with a single lesion or cavity. Observations on the cadaver prove to us that the greater the cavity the more likely the presence of secondary lesions elsewhere, but the usual clinical signs as elicited by a physical diagnosis cannot be relied upon in the selection of the suitable from the unsuitable cases. Given a case with cavity formation, it would be useless to hope for recovery by operative measures directed toward obliteration of the cavity if there are secondary foci in other portions of the lung. While it is usually possible to demonstrate the presence of a large cavity, it is correspondingly difficult to elicit the physical signs in one the size of a hazel-nut; and yet the smaller the cavity the greater the chances of

operative recovery. Gaffky's table showing the number of tubercles in a microscopical field gives us no idea of the extent of destruction of lung tissue.

It was hoped that the X-ray would be of some service in overcoming these difficulties—*i. e.*, in distinguishing between cases with single and cases with multiple abscesses; but, as a rule, the radiographic pictures have proved very deceptive.

Multiple cavity formation should be regarded, therefore, as the foremost contraindication; but, in addition to the local condition, the patient's general condition must be taken into consideration. Amyloid degeneration of the kidneys, degeneration of the myocardium, and hectic fever should be recognized as contraindications.

Since repair of the cavity is effected after these operations by shrinkage and contraction of its wall, operative intervention must be much more radical, for anatomical reasons, when the cavity is situated in the upper lobe than when it is situated in the lower lobe. Quincke calls attention to the fact that the nearer one approaches the base of the lung the more compressible the thoracic wall, and, *vice versa*, the nearer one approaches the apex the more rigid and incompressible the thoracic wall. In the earlier operations the lesion was exposed by the removal of but a few centimetres of one rib; the rigidity of the thorax was not overcome, the cavity did not fill up with granulation tissue, and the destructive process advanced unimpeded. We now know that only by an extensive thoracoplasty can we hope to effect a cure.

As in the drainage of empyemata, so with pulmonary abscesses it is important that the opening be situated at a point best adapted for natural drainage, and to this end the excised rib must correspond as nearly as possible to the most dependent portion of the cavity. It will usually be found that the nearer the cavity is toward the lower lobe the more difficult will it be to effect adequate drainage. Since Quincke introduced his plan of extensive rib resection two operations have been carried out with favorable results. One of these was performed by Turban upon a young man with tuberculosis of the left apex; an incision, 14 cm. long, was made, and a wedge-shaped section from the fourth to the seventh rib was removed. At a subsequent operation this opening was still further enlarged. Two and a half years after the operation the patient was reported well, although his sputum still contained tubercle bacilli.

When the pleura is exposed by a sufficiently extensive resection of the ribs the question arises as how best to divide this membrane. Sarfert¹ has shown by his observations upon the cadavers of 150 phthisical

¹ Deutsch. med. Wochenschrift, February 14, 1901.

subjects that in almost all chronic cases adhesions were present as far down as the third rib if the cavity is in the apex ; whether they extend further than this must be determined by careful palpation. The absence of adhesions will very materially affect the result, as illustrated by Lawson's case, in which after extirpation of the apex of the lung, in the absence of adhesions, the patient developed a hæmothorax, and later succumbed to an empyema. As Sarfert has put it, just as we avoid the peritoneum in performing a pyelonephrosis and perityphlitic abscess, so in operating upon the lung the work must be extrapleural. The method which Sarfert devised after his work upon the cadaver is as follows : " Incision over the second rib from the sternum 10 to 11 cm. long. Skin and subfascial tissue separated, then the acute angle of the pectoralis major, with some fibres of the pectoralis minor. Several arteries which will be encountered must be ligated, along with their veins. The incision extends into the insertion of the serratus anticus major. The second rib is then isolated as far as the axillary cavity, and the axillary vein and artery come into view. The periosteum over the second rib is split longitudinally and peeled off, on the under surface as well, and also over the cartilage. The rib is easily removed with a chain-saw or cutting forceps ; in so doing we must avoid opening the anterior mediastinum. The second stage of the operation consists of detaching the pleura from the thorax. This is done bluntly by the fingers, considerable force being necessitated at times. The pleural cavity itself is not opened. As a matter of fact, there hardly exists such a cavity any longer, as it is usually obliterated in that locality. We need not fear causing a pneumothorax.

" If the lung apex has now been laid bare extrapleurally we must proceed to determine the size and locality of the cavity. This is accomplished by inspection, palpation, and trial puncture. The cavity is opened either with knife or Paquelin cautery. There need be no fear of wounding large vessels. The interior of the cavity now being visible, it is carefully inspected to determine its relationship to the bronchi and accessory cavities. Some of the vessels which traverse the walls may require ligation. In the case of a woman, aged forty years, operated upon by the author, the conditions encountered in the right apex corresponded closely to those seen in the cadaver. In resecting the second rib dense adhesions were found. The loss of blood was remarkably small. The position and size of the cavity were made out by palpation. The larger as well as the smaller cavity could be tamponed conveniently. The space formed by the operation between the apex of the lung and thoracic walls filled in with granulations. The hectic fever immediately ceased, and hæmoptysis did not recur. At the end of three months a small crater-like space in the centre of a granulating

surface 3 cm. broad marked the site of the intervention. The patient seemed to be doing well, when, two months later (five months after operation), she died of an intercurrent pneumonia of the left lower lobe. Autopsy showed the right apex transformed into connective tissue, a very few tubercles being scattered here and there."

The cavity need not be opened at the first sitting; if the adhesions are not firm enough this step of the operation may be postponed until the pleural cavity is securely walled off. It is necessary to open large cavities in every instance, in order to obtain resolution; but in the case of small cavities resolution may ensue without drainage. There has been considerable controversy over the relative superiority of the knife to the cautery in the opening of these cavities, but, as a matter of fact, it makes very little difference which is used. The wall of the cavity is not particularly vascular, so that in either case hemorrhage will not give the operator the least concern. The cavity, once opened, is loosely tamponed with gauze; tubular drainage cannot be inserted on account of the danger of secondary hemorrhage from injury of the vessels. If the operated side does not contract as rapidly as anticipated the process can be hastened by elastic compression, as suggested by Lichtenhauer, protecting the sound side with a sheet of zinc.

The results of surgical treatment of pulmonary tuberculosis have not been very encouraging—not so much because the operation is of itself difficult, but because the disease is, as a rule, too far advanced. In order to estimate the true value of this operation as a life-saving procedure, Berliner prepared a table from which he excluded all those cases in which sufficient time had not elapsed since the operation to warrant their being reported. This table includes but eleven cases.

No.	Author.	Position of cavity.	Method of operation.	Result.
1	Bier	Right, anteriorly	Pneumotomy	At first improvement; death in 10 months.
2	Franke	" "	"	At first improvement; death in 10 months.
3	Krecker	" lower lobe	"	Death from hæmoptysis.
4	Kurz	Left, upper lobe	"	Cavity healed; died in 3 years of general tuberculosis.
5	Mosler	" " "	"	Cavity healed; died a year later of general tuberculosis.
6	Neve	Right, anteriorly	"	General improvement.
7	Quincke	" "	"	Death in 2 years; general tuberculosis.
8	Sarfert	" "	"	Death in five months.
9	Sonnenburg	Left, "	"	Improvement; death in seven years.
10	Spengler	" "	Thoracoplasty	Recovery.
11	Turban	" upper lobe	"	Recovery? In excellent condition 2½ years later.

The few recoveries or improvements stand in marked contrast to the number of fatal cases. In recent years the results have not been so discouraging because of the more careful selection of cases by the medical diagnostician. In some cases the improvement should be attributed more to careful nursing, proper feeding, etc., than to the operation, although there are a few cases in which the improvement after the operation was most striking, as manifested particularly by the diminution in the quantity of sputa, a fall of the temperature to normal, and a manifest subsidence of the catarrhal conditions. In summing up the subject of the surgical treatment of tuberculosis in the present state of development, Berliner says: "Perhaps the most recent teaching not to open cavities, but to favor shrinkage of the diseased area by removal of the overlying ribs, is a step in the right direction, and offers to the surgeon a small field with bright prospects. No doubt the results would have been better had, as Spengler advised a decade ago, every patient been sent to a suitable climate soon, about fourteen days, after the operation.

"If we are conservative and cautious, and not blind and enthusiastic, it is possible that, with the surgeon and internist working hand-in-hand, the opinion of Leyden may be realized when he said the treatment of cavities is a problem of modern surgery from which much good is to be attained."

In speaking of the results of the operative treatment of lung disease, we might refer to the work of Körte, in the Urban Krankenhaus, Berlin, during the last decade. The series includes in all 29 operations—3 for gangrene, 6 for bronchiectasis, 12 for abscess (9 with empyema), 8 for empyema alone, and 1 for cancer. Tuberculous cavities have, without exception, been excluded from those in which operative intervention was considered justifiable. Körte has said that tubercular cavities should not be operated upon, and when tubercle bacilli appear in the sputum surgical intervention is contraindicated. As in the case of other observers, he has found great difficulty in confirming the diagnosis as to the situation of the lesion, its extent, whether it be single or multiple, and whether it falls within the scope of operative possibilities. The character of the sputum, its quantity, presence of tubercle bacilli, and more particularly of elastic fibres and lung tissue, would be of great assistance in establishing a diagnosis. Auscultation and percussion will, of course, render some assistance, but too much should not be expected of them, particularly if the lesion be superficial. Exploratory puncture will often prove of some assistance, although one hesitates resorting to it on account of the dangers of infecting the sound tissue through which the needle must penetrate. Skiagraphs have, as a rule, given us very little definite information as

to the seat and character of the lesion. Tuffier¹ claims, however, that he has been able to demonstrate by the skiagraph the presence of cavities when the physical signs were absent. In 8 of the 25 cases upon which these observations were made he had an opportunity to compare the results arrived at by physical examination with those attained by means of the radiograph. In 4 out of 5 cases the results of auscultation and percussion agreed with the radiograph, and in 1 of the 5 the results of these two methods of investigation did not agree. He found that the usefulness of the radiograph was somewhat restricted on the left side on account of the density of the heart. Echinococcus cysts cannot be recognized by the X-ray, although if, by any other means, their presence has been demonstrated they should be subjected to operation. Of the 29 cases which Körte operated upon, 14 died; 2 of the patients with gangrenous cavities recovered, and 1 died; 4 of the 5 cases of bronchiectasis died, and 1 recovered. In the treatment of pulmonary abscesses not of tubercular origin but 1 of the 12 cases died; the remainder recovered in the course of time. Out of 26 cases of tubercular cavities operated upon by Tuffier only 13 survived, and but 1 of these more than five years; 2 died the second or third year, while the others were lost sight of after the second or third month.

Pneumothorax. According to Delangenièrè, pneumothorax is unjustifiably considered a serious complication of operations—that is, when the pleuræ are healthy and non-adherent. If suddenly brought about it may be attended with serious results; but if, on the contrary, it is brought about slowly it is not attended with any danger, more particularly as we have a very simple method of arresting it while in process of formation. Delangenièrè's method consists in drawing the lung to the opening of the pleura and suturing it in place. He has applied the method in three cases of accidental opening of the pleura, with splendid results. In one case of penetrating wound of the lung it proved very efficient. After the operation is completed the air in the pleura should be withdrawn by means of a Potain aspirator. The lung immediately returns to its normal size, and the patients complain neither of painful nor difficult breathing.

On the ground that pneumothorax is not a serious condition in itself, when properly treated, Delangenièrè recommends the exploration and examination of the lung in those cases in which the diagnosis is uncertain and the pleuræ healthy. The lung can be carefully palpated and areas of induration and hepatization easily discovered. If a focus of disease has been discovered the portion of the lung affected is anchored to the pleura and the pleural cavity closed with sutures. The opera-

¹ *Revue de Chirurgie*, 1901, No. 8.

tion is terminated by making a free incision into the lung, removing the infectious material, and establishing drainage. If a pneumothorax exists after the operation the air should be removed by an aspirator.

The Surgery of the Pulmonary Complications of Pneumonia.

The pulmonary complications of pneumonia amenable to surgical treatment are abscess, gangrene, and bronchiectasis, and of these abscess is the most frequent. Eisendrath,¹ who has studied the surgical aspects of pneumonia with some care, quotes the following statistics as showing the relative frequencies of these sequelæ: Of 750 cases of fibrinous pneumonia, collected by Sello, abscess was found in 11, or 1.5 per cent.; of 255 cases, collected by Aufrecht, in 2 cases, or 1.2 per cent.; or in approximately 1000 cases about 1.3 per cent. As to gangrene, Grisole found none in 305 cases of pneumonia, and in 70 cases of gangrene found pneumonia preceded gangrene only 5 times. A. Fränkel found that 7.5 per cent. of all cases of influenzal pneumonia terminated in gangrene; Sello, in 75 cases of croupous pneumonia, found it only 3 times; Aufrecht, in 1501 cases, never observed it. There are no available statistics bearing on the frequency of bronchiectasis. As to the etiology, the following organisms have been found in abscesses: *Pneumococcus*, the colon bacillus, the influenza bacillus, and the Friedländer organism. Gangrene itself may be caused by some of these organisms; it may follow the partial aspiration of a bronchiectatic cavity, and, especially in epidemics, has been attributed to a specific organism.

The lesions that present themselves for treatment may be classified as follows: Acute simple abscesses; chronic simple abscesses, with or without bronchiectasis; acute gangrenous abscesses; and chronic putrid abscesses, with bronchiectasis. As to the symptomatology of pulmonary abscess, the following is the usual history: "A patient who has had pneumonia, for example, of the lower lobe will have his crisis, the physical signs begin to clear up, the temperature drops, when suddenly the temperature goes up again, becomes of a remittent type, and the sputum becomes more purulent. There may be a distressing cough, accompanied by the expectoration of pus in large quantities. Some elastic fibres may be present, but are rare. There are often paroxysms of coughing, with expectoration of several ounces to a cupful of pus. If the abscess cavities do not communicate with a bronchus there is but little expectoration. There is in all cases emaciation, loss of appetite, and a rapid decline in strength. If the abscess becomes chronic there may be recurrent attacks of fever, with a great deal of expectoration. Physical examination is rather disappointing. There are few cases in

¹ Philadelphia Medical Journal, November 9 and 16, 1901.

which there are cavity signs present, either due to an indirect manner in which the abscess communicates with the bronchus, or to its not opening into one at all. The pulmonary lesions following pneumonia are most frequently in the lower lobes, and this is of some aid. There are no typical physical signs, owing to the fact that the cavities (be they due to abscess, gangrene, or bronchiectasis) may be near the surface or quite deeply situated, and may or may not communicate with a bronchus. Dulness, decreased respiratory murmur, vocal resonance, and fremitus are present in the majority of cases, but we may have bronchial breathing. The most reliable sign is the presence of râles—large, moist ones, not infrequently metallic in character. Another striking feature is the variability of the physical signs—once dulness, then tympany at the same spot. A pus cavity, surrounded by aerated lung tissue and not communicating with a bronchus, gives no auscultatory phenomena. Clubbed fingers develop quite early, as do also pressure symptoms on the heart, liver, and spleen. If after a pneumonia the fever either does not disappear or begins a few days after a crisis, and the sputum and breath become fetid and divides itself into the characteristic three layers, gangrene must be suspected. This, as Fränkel has shown, is a frequent sequel of influenza pneumonia. In the sputum of gangrene one can usually find elastic fibres. In bronchiectasis following pneumonia the sputum may be fetid at times, but the odor is not so penetrating and there are no elastic fibres. The physical signs of both gangrene and bronchiectasis are most frequently the same as those of abscess. In a patient with bronchiectasis there is usually a history of long-continued expectoration, with sudden expectoration of large quantities of pus. This, however, is not characteristic, for the same may be true of chronic simple abscess. There is said to be more mucus in the sputum of a bronchiectasis, but if there are cavities in the lung tissue due to ulcerations of bronchiectasis there may be just as much pus as from a simple abscess and, if there is associated gangrene, just as much fetor as in a gangrene. The frequency of hæmoptysis in cases of gangrenous process is due to the fact that the vessels are more apt to pass freely through the cavity, owing to the more rapid destruction of tissue."

The previous history of pneumonia, particularly an influenza pneumonia, and the character of the sputum—which in abscess is of a chocolate color and occasionally contains elastic fibre, and in gangrene becomes more and more offensive as the case progresses—are important points in the establishment of a diagnosis. In bronchiectasis the sputum is at first odorless, but usually becomes foul from the stagnant pus. The localization of the abscess is always difficult; aspiration is dangerous; physical signs are not reliable and often misleading. The

X-ray is only of confirmatory value, as it shows chiefly thickened areas of lung, and should not be absolutely relied upon. When it shows a shadow at the same point where the physical signs are present it is of value. The latter may mislead one as to the seat of the abscess, and is of no service in distinguishing between single and multiple foci. We have already referred to Tuffier's report of his observations of the application of the X-ray to the diagnosis of pulmonary abscess.

The prognosis in abscess, gangrene, and bronchiectasis is always grave; a few cases have terminated in spontaneous resolution, but the majority become chronic, and sooner or later the patients succumb to the effects of chronic intoxication. After surgical intervention the prospects are particularly bright, especially in acute cases. In a series of 93 cases of lesions following pneumonia the following were the results of operative treatment:

	Recovered.	Improved.	Died.
Acute simple abscess, 25 cases . . .	96.0 per ct.	4.0 per ct.	0.0 per ct.
Acute gangrenous abscess, 28 cases . .	71.4 "	7.2 "	21.4 "
Chronic simple abscesses, 14 cases . .	42.8 "	21.4 "	35.8 "
Chronic putrid abscesses, with bronchiectases, 26 cases	50.0 "	15.3 "	34.7 "

The following are the statistics of other observers showing the results of surgical intervention:

M. Reclus, in his address to the French Surgical Congress, 1895, gave statistics from various sources of 117 cases of all varieties operated on between 1879 and 1895, with 68 recoveries, a mortality of 42 per cent. His own statistics between 1885 and 1895 comprise 14 cases, with 12 recoveries, a mortality of less than 15 per cent.

Schultz collected 31 acute cases due to all causes; of these 22 recovered (73.3 per cent.) and 8 died (26.7 per cent.). Of chronic cases he collected 51; of these 26 recovered (51 per cent.), 12 were improved (23.5 per cent.), and 13 died (25.5 per cent.). These were not cases following pneumonia exclusively, but from all causes. Quincke collected 47 cases.

	Recovered.	Improved.	Died.
Acute simple abscesses, 7 cases	6	0	1
Acute gangrenous abscesses, 13 cases . .	7	0	6

We thus see that in his acute cases (simple abscesses) there were 85 per cent. of recoveries and 15 per cent. of deaths; in the acute gangrenous cases there were 53 per cent. of recoveries and 47 per cent. of deaths.

	Recovered.	Improved.	Died.
Chronic simple abscesses and bronchiectases, 8 cases .	1	5	2
Chronic putrid abscesses and bronchiectases, 19 cases	4	7	8

This makes the percentage in his chronic cases 12 per cent. recovery for the simple cases, 60 per cent. improved, and 24 per cent. died. For the chronic putrid abscesses and bronchiectases the percentage of recovery is only 21 per cent.; percentage of improvement, 36 per cent., and 43 per cent. deaths.

These statistics are a striking demonstration of the marked increase in the percentage of recoveries during the past ten and particularly five years. The advance in the treatment of these pulmonary lesions must be attributed chiefly to earlier recognition and more prompt submission to treatment. If at the end of from four to six weeks the abscess has not undergone resolution there should be no further delay in operating. The results obtained in chronic cases are naturally not so good, not only on account of the emaciated and septic condition of the patient, but because the local conditions have become so unfavorable for healing.

The methods for exposing the lesion in the lung depend upon the presence or absence of pleural adhesions. Fortunately, in a large majority of cases—about 90 per cent.—these are already formed, so that the operation may be completed in one step. If adhesions are absent one of several methods may be adopted to excite their formation; the layers of the pleura may be sutured together, the pleural cavity may be walled off with gauze, or the gauze may be sutured in place around the edge of the wound (Krause). Pneumothorax and collapse of the lung may be avoided by using extralaryngeal insufflation with O'Dwyer's or, preferably, Matas' apparatus. From two to four ribs should always be resected in chronic cases and when the diagnosis is uncertain; if there is reason to believe the lung is contracted it is better to resect the periosteum also. The removal of the thickened pleura will facilitate the contraction of the cavity. Tubular or capillary drainage may be employed, but irrigation should be regarded as dangerous. If large bronchi communicate with the cavity, and a fistulous tract remains, the wound should be opened, the bronchi cauterized, and that portion of the lung removed which forms the wall of the abscess. Failure of the cavity to heal may be treated by a more extensive resection, followed by compression. Chloroform is the safest anæsthetic; anæsthesia should be as complete as possible, except when the patient's condition is poor.



INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM, CROUPOUS PNEUMONIA, AND INFLUENZA.

BY FREDERICK A. PACKARD, M.D.

DISINFECTION AND INSECT TRANSMISSION.

THE whole question of the transmission of disease by insects is, we may say, still in its infancy. The aim of such investigations as have been undertaken is the stamping out of disease. In the case of plague (as will be noted under the heading of that disease) a new effort has been made to determine some measure by which the bearer of the disease in that infection—viz., the rat—may be exterminated. An interesting question arises as to how much of the supposed value of former methods of disinfection against, for instance, yellow fever, may have been due to the action of the means employed upon the bearers of the infection. As has been mentioned before in preceding volumes of *PROGRESSIVE MEDICINE*, experimental work on the extermination of the mosquito has been pushed with much energy within recent years, and has brought forth practical fruit in no place more strikingly than in Havana, Cuba, during the temporary control of affairs by representatives of the United States Government. Such control over the multiplication of mosquitoes cannot be expected in all countries with which we have communication. It is therefore important that it should be determined just how the insect can be destroyed after its contamination and before its entrance into another port. For this reason the experiments of Rosenau¹ are of great interest. Rosenau used for his experiments specimens of the *Culex pungens* raised in the laboratory. These were exposed, in jars covered with gauze or in small pill-boxes with gauze lids, to disinfectants applied in various ways. In order as nearly as possible to imitate the actual condition of affairs in nature, crumpled towelling and paper, sometimes dry and sometimes moist, were placed in the jars containing mosquitoes, in order to imitate conditions possibly present in a room or in the hold of a ship, and to furnish such refuges from the disinfecting material as would be actually present in practical work. A sufficient number of mosquitoes or receptacles

¹ Bulletin No. 6, Hygienic Laboratory, U. S. Marine Hospital Service.

containing mosquitoes were used to avoid errors arising from the naturally high mortality of mosquitoes in artificial conditions. Spore-bearing bacilli, as well as some not bearing spores, were also exposed for comparison as to the relative germicidal and culicidal action of the disinfectants. It was found that formaldehyde gas kills mosquitoes promptly whenever the vapor came in a state of concentration in direct contact with the insect. The difficulty of rendering a room or chamber of any kind absolutely air-tight, and the readiness with which insects seek places of safety in the folds of garments, drapery, etc., made it necessary to determine just how much concentration and how close contact was necessary in order to produce the desired culicidal effect. Sheets sprayed with 40 per cent. formalin solution in the proportion of 1 ounce to 100 cubic feet of room space were hung in a chamber of wooden construction with much opportunity for leakage. After an exposure of six hours it was found that almost no effect was produced upon a lot of mosquitoes not very well protected from contact with the gas, while all the non-spore-bearing organisms and some of the spores were killed after a similar length of exposure. In another experiment, carried out in much the same way, it was found that mosquitoes exposed freely to the action of the gas without any protection were killed, while of those protected from full contact with the gas (in the pocket of a coat, under layers of towelling, etc.) either all or many survived, while micro-organisms exposed in the same place were most of them killed.

The third experiment was performed by exposing mosquitoes under similar conditions to the fumes of formic aldehyde furnished by a Kuhn lamp. A similar result to that obtained in the last experiment was reached. The same happened with excessive amounts of gas generated in the same way. With other forms of formaldehyde generators practically the same result was obtained.

The long-established method of disinfection by the use of sulphur inspired Rosenau to test the culicidal power of the vapor of sulphur dioxide. He found that even very dilute atmospheres of the gas quickly killed all mosquitoes, no matter whether the gas was used dry or moist. Its penetrating power also was found to be very satisfactory, as even in very dilute portions mosquitoes were killed in one hour's time, although they were hidden under four layers of towelling.

It is evident, therefore, that these two substances—formaldehyde gas and sulphur dioxide—fill two different indications in preventive medicine. For the destruction of micro-organisms formaldehyde is undoubtedly the better agent to be employed. Where, however, the disease is transmitted through mosquitoes, as now must be conceded to be the case with yellow fever, sulphur dioxide should be chosen.

Recently an apparatus has been devised whose object is the extinction

of fires on board ship by means of dry sulphur dioxide gas. The tests which have been applied to the apparatus seem to prove that by its use fire in the hold of a ship can be promptly extinguished, so that the installation of such machinery may be expected to become quite a feature in marine insurance. The use of such an apparatus in every large port may be a powerful factor in preventing the spread of such diseases as plague and yellow fever. A sufficient amount of sulphur dioxide, it is said, can be generated in twenty-four hours to completely charge the interior of the largest vessels, destroying all the animals present, such as rats, fleas, and mosquitoes, and having certainly some germicidal action upon non-spore-bearing micro-organisms. The results of some of the experiments with this apparatus are given in the *British Medical Journal*, April 27, 1901, and May 11, 1901, p. 1170. In the latter communication it is stated that the process of disinfection was completed in fifteen hours, all the rats being found dead near any chance openings which happened to be left from which a little air might be obtained. The installation of such a fumigating apparatus may be a ready means of preventing the transference of plague-infected rats from vessels to a plague-free port.

RHEUMATISM.

Bacteriology. During the past year the additions to our knowledge of the etiology of acute articular rheumatism have been chiefly confirmatory of results previously obtained.

The excellent work recently done by Poynton and Paine (*A Critical Review of the Bacteriology of Rheumatism*¹) is well worth perusal. They again state their conclusions, based on a study of eighteen cases of rheumatic fever, that the diplococcus described by them is the cause of that infection, while they have been entirely unable to obtain from their cases the pathogenic cocci which have been urged so strongly by Singer as the cause of the disease.

Fritz Meyer² has contributed a valuable article upon the bacteriology of this disease. In five cases of typical acute articular rheumatism he found, on bacteriological examination of the throats, bacteria which called forth in animals a form of disease resembling human polyarthritis. Cultures from the throats of these patients showed rather small streptococci arranged as diplococci, usually growing in short chains in the tonsillar mucus, but forming long chains in culture media. They were well stained by the usual dyes, but were less well

¹ *British Medical Journal*, September 21, 1901, p. 779.

² *Deutsch. med. Wochenschrift*, February 7, 1901.

stained by Gram's method than are the pathogenic cocci. On ordinary media the organism grew sparsely, but on those with somewhat high alkalinity and containing much peptone they grew well. The best culture medium was found to be blood-serum agar. By culture they showed as delicate, clear, separate drops which, under the microscope, were found to be of a dull yellow color and granular appearance, with a dark centre. Bouillon became diffusely clouded by the growth, and after some days showed a small flocculent sediment. Milk was curdled after thirty hours. The cultures were extraordinarily labile, and after a short time were not capable of propagation. Similar organisms were never found in control examinations made of the bacterial contents of the throat in such diseases as scarlet fever, sepsis, influenza, tuberculosis, and muscular rheumatism. Subcutaneous injection of a two-day-old bouillon culture gave local necrosis with abscess formation. After the lapse of from six to ten days swelling of the joints was noticed, and the presence of a serous or seropurulent exudate; in the latter the same bacteria were secured as were found to be present in the throat. Usually three or four joints were involved. Similar results were obtained from intravenous injections. Among the animals that died eight had pericarditis, with clear serous effusion; three had peritonitis, and one pleuritis. Examination of the fluid so found gave no bacteria. In seven animals (a fifth of the whole number) either verrucose or ulcerative endocarditis was found. Examination of the blood was negative.

At the meeting of the Verein f. innere Medicin in Berlin, held January 14, 1901,¹ the paper by Meyer was discussed by Litten. He states that at that time he had under observation two cases of acute articular rheumatism with multiple, but not very severe, swelling of the articulations, one of which had endocarditis, the other no complication. In both there was a slight reddening of the pharynx and swelling of the tonsils, of which neither patient had complained. In both cases he incised small pieces from the tonsils, and in both he found diplococci which were arranged in chains. In these cases the diplococci were of slightly different size. In the case wherein the individual cocci were smaller, culture on bouillon gave diffuse clouding of the medium, while in culture from the second case in which the cocci were larger, a "clumpy" precipitate was present. A large number of guinea-pigs were inoculated with varying doses. Those which received more than a half centimetre of cultures from the first case died rapidly. In the animals dying so quickly, as would have been expected, nothing was found. Another animal, given a weak dose of the culture from the

¹ Abstract in Vereins-Beilage der Deutsch. med. Wochenschrift, February 7, 1901.

first case, had at the time of the meeting showed evidence of involvement of the joints. The cultures from his second case had up to the time of discussion given no characteristic results. Leyden in the same discussion says that he sees no reason why it should not be recognized that in this small, delicate diplo-streptococcus we had not the cause of acute articular rheumatism. He points out that, as the cocci are so delicate that they quickly die, they ought to be sought at the place where the infection occurs, namely, the tonsils.

Achalme,¹ in an interesting article, reviews the work already published by him in 1891 and in 1897 in regard to the bacillus described by him as the cause of articular rheumatism. He now states his belief that it is to be found in the healthy individual, and that probably it is an ordinary saprophyte, whose development in the blood is favorably influenced by the action of heat or cold. He also concludes that it may propagate in the serous membranes of the endocardium, or pericardium, or in the pleura, even before articular symptoms manifest themselves. The symmetry of the lesions in the joints seems to him to indicate that the arthritis or synovitis is due to the absorption of toxins and not to the bacillus itself, the latter of which he believes is usually lodged in the heart muscle. Possibly this lodgement in the heart muscle may explain the existence of carditis without articular symptoms.

Predtetchensky² obtained pure cultures of a streptococcus from the blood in two out of five cases of typical articular rheumatism. Animals inoculated with these cultures showed an articular affection resembling that of the human being from whom the cultures were made.

Gustav Singer³ has again contributed an article upon the etiology of acute articular rheumatism. He reports five new cases of acute articular rheumatism together with two cases of rheumatic chorea. In five of these seven cases streptococci were found, while in two a staphylococcus was present. He again reiterates his belief that the streptococcus is the cause of acute articular rheumatism, in spite of the fact that it has been found only in the heart and lungs, and not in the joints as yet.

Hemiplegia Complicating Rheumatism. From several points of view the article by Barbier and Tallemér⁴ is of much value. They report a case of rheumatism with vegetative rheumatic endocarditis and multiple emboli. On the fourth day of the illness, without an apoplectic attack, motor aphasia was noted, and this was followed by right-sided hemiplegia involving especially the face. Toward the end

¹ Gazette Médicale de Paris, April 6, 1901.

² Vratich, June 29, 1901; Abstract in Journal of the American Medical Association, August 21, 1901, p. 609.

³ Wiener klin. Wochenschrift, May 9 and 16, 1901.

⁴ Annales de Méd. et Archiv. Infant., February 1, 1901.

of the disease meningo-encephalitis appeared, and at the same time a bed-sore formed over the right side of the sacrum, with purpuric spots in the same region. At autopsy the trunk of the left Sylvian artery was found to be totally obliterated, as were also arteries going to the striate and lenticulo-optic nuclei on the left side, the left anterior cerebral artery, and some arteries on the right side of the brain. Another case was reported of a girl, eleven years of age, with vegetative endocarditis, multiple emboli, aphasia, and cerebral softening, which were followed by death. Many peculiar bacilli were discovered. Those stained by Gram's method were slightly larger and longer than the typhoid bacillus, and were found in the mitral vegetations. The authors believe them to be the same bacillus as that described by Achalme and Thirolaix.

Skin Lesions. The occasional occurrence of surface lesions in the course of rheumatism has been noted repeatedly; the exact nature of the lesions, however, is but little understood. The belief that they are due to some unknown systemic poison which involves the skin cannot be substantiated, and it is certainly more rational to believe that the surface lesions on the skin and mucous membranes are another result of the poison of rheumatism (be it toxin or purely chemical alteration) which has called forth the lesion in the joints. Behrend¹ has reported three cases having a bearing upon this subject. In the first case a boy, aged fifteen years, was seen with mitral insufficiency. He developed an erythematous eruption on various parts of the body, involving not only the skin, but the mucous membranes. The reporter believes that both the heart lesion and the erythema were rheumatic in origin. In the same paper he reports the case of a man with exudative erythema and swelling of the right wrist, the latter being probably the result of an injury. He also mentions a third case, where with hemorrhagic eruption of the legs there were signs of mitral insufficiency. Of course these cases do not bear on their face distinct proof of their rheumatic origin, nor is it very evident that careful investigation might not have shown a primary lesion on the surface of either skin or mucous membranes through which invasion might have occurred, with the articular, cardiac, and cutaneous manifestations, as a result of the action of the infecting agent.

TYPHOID FEVER.

Nomenclature. In the *British Medical Journal* of the past year there has been an interesting discussion regarding the naming of the infection by the bacillus of Eberth. The question of nomenclature is

¹ Münchener med. Wochenschrift, July 9, 1901.

one about which there has been a great deal of useless discussion, and it would seem a small matter for controversy. Since our ability to more definitely recognize the bacillus of Eberth by bacteriological methods, and clinically in certain cases to employ the Widal reaction as a confirmatory sign of infection by this organism, cases are constantly being reported where the infection of the organism has apparently occurred from some point besides the intestinal tract, such as the pleura, the bladder, and the lung. It is manifestly improper, therefore, indeed it is misleading, to name the disease after a particular portion of the body which apparently may be absolutely uninvolved in the infectious process.¹ The word enteric fever implies nothing as to the etiology, and is especially inappropriate where the intestinal tract is uninvolved. To the term typhoid fever two objections can be made. In the first place it links the disease to some extent with typhus fever, which is, of course, a distinct entity. In the second place, the term typhoid has been applied to this infection because of the fact that in the majority of the cases patients sink into a state resembling that seen in typhus fever, the same state being frequently seen in other infections, such as those by the pyogenic cocci. To this group of symptoms and signs the term typhoid state has been applied—a widening of the term, which, of course, is not desirable, but which usage has established. The term typhoid pneumonia might mean either pneumonia occurring in the course of typhoid fever or pneumonia with asthenic and “typhoid” characteristics. In this country it is probable that this use of the term “typhoid” has had something to do with the unreasonably long use of the term “typhomalarial fever.” Any malarial subject may present the typhoid state, yet it is now definitely recognized that the combination of the two infections by the bacillus of Eberth and by the malarial plasmodium is quite rare. A refinement in nomenclature, to which objection could only be raised by the fact that a proper name is used to designate the trouble, would be Eberthian infection, which, it must be admitted, is a clumsy and not particularly desirable name. In view of our knowledge that in typhoid fever the intestine is affected only when and because it is the portal of entrance for the infective agent; that the condition described by the word typhoid is pre-eminently the one most frequently and most completely resembling the appearance found in typhus fever, and in view of the fact that it has for a long time held its place in medical literature, the term typhoid fever is probably less objectionable than is that of enteric fever.

T. J. Maclagen has considered some questions in connection with this subject of the name “typhoid fever.” He points out what must be

¹ For arguments against this non-involvement of the intestine, see Opie's article quoted below.

conceded as true, that the fever which is so prominent a symptom is due not to the local lesion in the bowel, but to material absorbed therefrom. Maclagen states that the fever is due to the virulent bacilli found in the circulation, the chief action of which is the consumption of nitrogen and water, and consequent increased diminution of weight, thirst, loss of appetite, wasting, etc. Undoubtedly, however, we must believe that toxin formation and absorption is a more potent factor in causing the symptoms of the disease than is the simple chemical action as regards the consumption of nitrogen and water.

Statistical. Dr. James Stewart,¹ of Montreal, has given an interesting résumé of 620 cases of typhoid fever which have been treated in the Royal Victoria Hospital since 1894. In 93 per cent. the onset was slow and characterized by frontal headache, malaise, and anorexia. In the other 7 per cent. the onset was sudden, resembling pneumonia or pleurisy. In 5 or 6 cases the onset resembled appendicitis. Repeated rigors and chills occurred during the first week in 10 per cent., epistaxis was present in 12 per cent., and in 0.5 per cent. there were signs of meningitis. The mortality was 5.4 per cent., which must be considered a very good average for a long-continued series of cases. Of the fatal cases, death was due in 58.8 per cent. to perforation or hemorrhage, while in the remainder it was caused by other factors. Out of 11 cases of perforation operative measures were employed in 8, without recovery. Decided hemorrhage occurred in 5.58 per cent. of his cases, and hemorrhage was the cause of death in 26.4 per cent. of his fatal cases. Seven of his cases had cholecystitis, all but one of which recovered. Relapse occurred in 9 per cent. of his cases. Serum diagnosis was employed in 370 of the cases, and was positive in all but 8. Out of 96 cases examined for the Widal reaction on the day of discharge a positive result was obtained in all but 6. In one of the 620 cases intestinal lesions were absent.

The proportion of cases in which the onset was sudden (7 per cent.) was quite large. It again emphasizes a point, which was spoken of in this article two or three years ago, that the onset may be sudden, and unless one is on his guard this atypical mode of onset may lead to error. The five or six cases which began like an attack of appendicitis are extremely interesting, especially in view of the frequent articles in recent times regarding the mutual relation of typhoid fever and appendicitis.

Aberrant Types. AFEBRILE TYPHOID FEVER. Two cases of afebrile typhoid fever have been reported by Whalen.² One of these

¹ British Medical Journal, June 15, 1901.

² Journal of the American Medical Association, February 2, 1901.

occurred in a male, aged twenty-three years ; the other in a boy, aged seventeen years. Except for the constant absence of fever the cases were in no wise different from the ordinary run of instances of this disease.

RIGORS IN TYPHOID FEVER. The occasional occurrence of rigors in the course of typhoid fever has attracted more attention recently than was ever given to this subject before. The subject is of particular interest in connection with the varying degrees of shivering produced in different patients by the same measure of hydrotherapy. A case has been reported recently by Dickinson,¹ wherein rigors, accompanied by rise of temperature followed by sweating, occurred at varying intervals in a case coming under his observation. The last of these rigors occurred during the sixth week, and at the time of its occurrence the temperature rose to 105° F.

HEMORRHAGIC TYPHOID FEVER. During the past year a considerable amount of attention has been devoted to the subject of hemorrhagic typhoid fever. In a very interesting article in *Johns Hopkins Hospital Reports*, 1900, vol. viii., p. 309, Hamburger urges that the term should be applied to bleeding from various mucous membranes, and not merely to those cases which have profuse epistaxis, hemorrhage from the bowel, or other solitary mucous membrane hemorrhage ; in other words, the term hemorrhagic typhoid fever should only be used where the tendency to hemorrhage is marked by bleeding from sources not usually involved in typhoid fever, or from extremely obstinate hemorrhage from one or two of these sources beyond that which might be called the normal for the disease. Hamburger reports in his paper a patient who, after seven days of apyrexia, and while still on a liquid diet, had a sudden rise of temperature to 103° F. as the first evidence of a relapse. Eleven days after the onset of the relapse he began to expectorate blood, without cough, the sputum being described as bright red and frothy. The blood was found to issue from between the teeth, no bleeding-points being present on the fauces or pharynx. Purplish ecchymotic spots occurred along the jaw and in the sternal notch, with two lines of hemorrhage beneath the clavicle and groups of petechiæ in the axillæ. Fresh hemorrhages occurred later in other portions of the surface. The blood-count showed only slight anæmia, but the coagulation-time during the period of hemorrhage was found to be ten minutes, whereas after recovery the coagulation-time was found to be only four minutes.

Nicholls and Learmouth² quote 4 cases as occurring in a series of 200 typhoid fever patients in the Royal Victoria Hospital of Montreal, and

¹ Edinburgh Medical Journal, April, 1901, p. 334.

² Lancet, February 2, 1901.

state that in 12,000 tabulated cases this condition was present in only 18. In 3 cases hemorrhages were found in the skin, lungs, heart, kidneys, spleen, intestines, bladder, gall-bladder, and connective tissues, with acute diffuse nephritis and fatty degeneration of the capillaries of the lungs and kidneys.

Eshner and Weisenberg¹ have reported two cases, one of which should certainly be classed as hemorrhagic typhoid fever, the other being doubtful. In the definite case the patient gave the history of having been a heavy drinker, and was admitted to the hospital delirious with typical symptoms of typhoid fever. On the sixth day after admission an eruption described as rose-red, and not disappearing on pressure, was present. On the same day hæmaturia was noted, and a papular eruption was found over the whole body. At about the same time there occurred a severe intestinal hemorrhage and extravasation of blood into the left eye. At autopsy there were present characteristic lesions in the intestines and blood in all of the serous cavities.

ABSENCE OF WIDAL REACTION. One of the most interesting communications of the year in regard to the subject of typhoid fever is one by Kurth.² In this paper he describes five cases which clinically resemble typhoid fever except for the fact that the Widal test was negative in all. From these he obtained a bacillus which microscopically and culturally differed from the typhoid bacillus, and did not react to the Widal test with typhoidal serum. It does, however, give marked clumping with serum from the patients from which the bacillus was derived in dilutions of 1 to 500 up to 1 to 8000. It was an active bacillus of the size and general shape of the typhoid bacillus, but the flagellæ were longer and more numerous than they are in the latter. Staining by Gram's method gave negative results. Growth on gelatin and on other media differed from that of the bacillus coli communis and others of the group, but resembled that of the *B. typhosus*.

ABSENCE OF INTESTINAL LESIONS. A case reported by Lazarus-Barlow³ is one of typhoid fever without intestinal lesion, occurring in a thirteen-months-old child. The doubt recently raised as to the occurrence of typhoid fever in children under the age of two years (a doubt which has met with sufficient refutation), and the recent expression of opinion that many of the cases of so-called typhoid fever without intestinal lesion were really not free from involvement of the digestive tract, makes the case one of great interest. Five other members of the family were suffering from typhoid fever at the same time. During life the Widal reaction was obtained immediately in a dilution of 1 to 50 on the

¹ American Journal of the Medical Sciences, March, 1901.

² Deutsch. med. Wochenschrift, July 25 and August 1, 1901.

³ British Medical Journal, September 21, 1901, p. 792.

seventeenth day of the disease, a reaction having been obtained the same day with a dilution of 1 to 100 after the lapse of fifteen minutes. At autopsy there was found bronchopneumonia, bronchitis, pulmonary collapse, and a firm, somewhat enlarged spleen. No other lesions were found in the body, and there was not the "slightest trace of any ulceration, either recent or old, in the intestine." There was no swelling of Peyer's glands or of the follicles, nor was there any congestion in the neighborhood. Apparently true typhoid bacilli were obtained from the spleen at autopsy.

A case bearing upon those previously reported as instances of typhoid infection without lesion of the intestine has been reported by Opie.¹ The patient was admitted to the hospital five days after the onset of her illness. She then had typical rose spots with enlargement of the spleen, and on the following day a positive Widal reaction was obtained in a dilution of 1 to 50. Successive crops of rose spots appeared. On the thirteenth day after admission (the eighteenth day of the disease) bleeding occurred from the lips and nose, and purpuric areas were found in the skin, in spite of the fact that the coagulation-time was found to be four minutes and forty-five seconds. Blood was also passed from the bowel a few days after the superficial hemorrhagic lesions were first noted. Later, fresh hemorrhages occurred beneath the skin in various parts of the body and from the nose. The child died on the twenty-sixth day of her illness from exhaustion. At autopsy the spleen was found enlarged, and the Peyer's patches in the lower portion of the jejunum and in the ileum were found to be raised only a little above the general level and to be very slightly nodular. The solitary follicles were visible as slightly elevated nodules. There was some enlargement of the lymphatic glands of the mesentery. Areas of vesicle necrosis were found in the liver, and in the sinuses of the mesenteric and retroperitoneal lymphatic glands were found the phagocytic endothelioid cells described by Mallory. The typhoid bacillus was found in the liver, gall-bladder and kidney. To the points above mentioned in the history of the case there should be added that in the early history of the illness there was noted diarrhœa, abdominal pain and tenderness and some distention. In addition to this at autopsy the solitary follicles of the large intestine showed minute points of pigmentation. They point out that in their case, which might be reported as one of typhoid fever without intestinal lesions, there were symptoms during life and pathological evidence after death of some involvement of the lymphatic structure of the intestinal canal. An interesting analysis of the previously reported cases of typhoid fever without intestinal lesions follows their

¹ Johns Hopkins Hospital Bulletin, July, 1901, p. 198.

paper. The article should certainly be read by anyone who in the future contemplates reporting a case of "typhoid fever without intestinal lesions."

Condition of the Blood. Thomas Houston¹ has contributed an article upon the anæmia of typhoid fever, and gives the history of a patient with a protracted attack of the disease, with epistaxis and hemorrhage from the bowels, phlebitis, and abscesses around the anus and in the axillæ. In the early stages the blood was normal except for slight leucopœnia, with increase in the large mononuclear cells. In the second stage, with no inflammatory complications, the hæmoglobin and red cells were considerably diminished, and the lymphocytes and mononuclear forms were not increased relatively to the other leucocytes. In the third stage the anæmia persisted, and phlebitis was added. Now the hæmoglobin fell somewhat lower and the leucocytes increased in number, especially as regard the polymorphonuclear forms. In what he calls the fourth stage, with increasing anæmia and decreasing phlebitis, the hæmoglobin fell still lower and the leucocytes again diminished in number. In what he designated the fifth stage the patient was profoundly anæmic, and abscess formation began. The hæmoglobin then reached its lowest point, the blood was of a chlorotic type, and the white cells were again somewhat increased, especially as regards the polymorphonuclear leucocytes. In the sixth stage (convalescence) the blood resembled that of the second stage. His conclusions are that the anæmia of typhoid fever tends to take on a chlorotic type, and that the leucocytes are always below the normal, and presented gradual diminution unless complications occur. Even if inflammatory complications should intervene, there is no great increase of the leucocytes, but the differential count is markedly altered. His explanation of the peculiarity of the blood in typhoid fever is that the anæmia is caused by an excessive amount of plasma and consequent dilution of the blood. It would seem, however, that this would cause the type of simple anæmia rather than that of chlorosis. He believes that this tendency to dilution which he thinks is present may be due to increased lymphatic activity in the alimentary canal.

Maurel,² from three experiments, with control tests, of human blood mixed with typhoid bacilli, concludes that human leucocytes do absorb typhoid bacilli, but that the cell dies in less than a half-hour thereafter. He therefore believes that these bacilli are most virulent for human leucocytes. In his experiments he found that the leucocytes never seemed to be either attracted or repelled by the bacilli. Absorption of

¹ British Medical Journal, June 15, 1901.

² Archives de Méd. expérimentale, etc., March, 1901.

the bacilli themselves, and not of their products, seems from his experiments to be harmful to the leucocytes. He also found that a temperature of from 103° F. to 104° F. was favorable to the leucocytes.

The frequency of the occurrence of the typhoid bacillus in the blood is the subject of an interesting paper by Cole.¹ In a careful series of experiments he found that out of fifteen cases of typhoid fever the bacillus was obtained from the blood in eleven. In the last seven of his cases the blood was diluted before it was placed in the culture medium, and from all of these bacilli were obtained. Apparently the presence of the bacillus in the blood has no relation to the severity of the attack. Most of his positive results were found during the second week, but some had been ill as long as twenty-seven days. In six of his cases the bacilli were found by culture before the Widal reaction was present. Cultures from the urine of twelve of the fifteen cases showed typhoid bacilli present in six. One case of special interest is detailed in which the diagnosis would have been impossible by any other means, although it should be said that in this particular instance while the diagnosis had been made by blood culture, the results of the tests were not determined until after the patient had died.

Bacillus Typhosus in the Rose Spots. E. Fränkel² studied the rose spots in five cases of typhoid fever in order to determine the seat of the bacilli in the exanthem. The portions of the skin containing the rose spots were placed in bouillon, in which they remained for eighteen hours at a temperature of 37° C. They were then washed in water, fixed with formol, and, after hardening in alcohol and embedding in celloidin, serial sections were made and stained with Unna's polychrome methylene blue. Even under a low power the groups of bacilli were seen as dark blue foci. In four cases the bacilli were in the papillary layer, in one in the reticular layer of the skin. The blood-vessels were always free, and the bacilli apparently lay in lymph paths. The papillæ near which the groups of bacilli lay were distinctly swollen, often to threefold the size of those near them. The stroma appeared to be exceptionally rich in cells, especially fixed connective-tissue cells.

In two of the cases, where the bacilli were especially numerous, there was apparent coagulation necrosis of the superficial epithelium and the stroma of the papillæ. Fränkel's observations would appear to prove what he claims, that the rose spot is not simply a hyperæmia of the skin, but is in reality a true lesion of the skin.

Widal Reaction in Children. The behavior of the Widal reaction in childhood was referred to in PROGRESSIVE MEDICINE two years ago,

¹ Johns Hopkins Hospital Bulletin, July, 1901, p. 203.

² Zeitschrift f. Hyg., 1900, p. 482.

and the statement was there made that the reaction very frequently appeared only late in the course of the disease. Thursfield¹ has studied the reaction in one hundred children. Forty-two gave a positive reaction. Of those that failed, no case proved to be typhoid fever. He states that repeated negative reactions are trustworthy proof that the case is not one of typhoid fever, and that a negative reaction later than the tenth day is strong evidence against the diagnosis of the disease. Our experience at the Children's Hospital in Philadelphia is quite different from this, inasmuch as frequently a positive reaction has only been obtained late in the case, sometimes after the temperature has fallen to normal. Morse² concludes from his study that the Widal reaction occurs under the same conditions and with the same limitations in children as in adults, but that there is some evidence to show that in children the reaction appears earlier, is feebler, and persists for a shorter time than is the case with adults. In the course of his paper he mentions one case where the reaction did not appear until the twenty-ninth day, as well as one in which the reaction was entirely absent up to the time of death.

Congenital Typhoid Fever. Another case of congenital typhoid fever has been put upon record within the past year. Brown³ has reported the following instance: A mother was suffering from typhoid fever when she was pregnant, almost at the full term. The child was prematurely born, and shortly after birth its temperature was found to be 101° F. The temperature rose to 103° F., but in spite of a subsequent diminution in temperature the child steadily grew weaker, and died at the end of two weeks. On the ninth day the Widal reaction was positive after a period of forty-five minutes' observation. Autopsy showed characteristic lesions of the ileum, of the mesenteric glands, and of the spleen. One of the interesting features in the case was the fact that intestinal lesions occurred, although, presumably, the intestinal tract was not the point of entrance of the poison. The only way by which the intestinal tract could be infected in intra-uterine life would be through the passage of the typhoid bacillus from the mother into the amniotic fluid, a condition that is not definitely known to occur.

Complications of Typhoid Fever. ACUTE SUPPURATION OF THE THYROID GLAND, occurring in the course of typhoid fever, has been mentioned before in PROGRESSIVE MEDICINE. The rarity of this complication makes it interesting to note that at a meeting of the Clinical Society of London, Mr. Rickman J. Godlee⁴ reported the case of a

¹ British Medical Journal, September 7, 1901.

² Archives of Pediatrics, May, 1901, p. 338.

³ Cincinnati Lancet-Clinic, April 27, 1901.

⁴ British Medical Journal, June, 1901, p. 1341.

young woman, who, toward the latter part of her attack of typhoid fever, noticed swelling of the lower portion of the neck, with a transient, patchy eruption over the whole body. There had apparently been moderate swelling of the thyroid region for some years. After the disappearance of the rash the swelling continued, and when seen by the reporter the swelling occupied the middle line, but extended on each side. Prompt relief followed incision and drainage. In the discussion a similar case was mentioned by Sir Thomas Barlow, where goitre had also preceded the infection with typhoid. In this case suppuration did not occur, but, owing to the great amount of swelling of the thyroid gland, tracheotomy was necessary. The case died after the operation.

LARYNGEAL STENOSIS. In the last year or two considerable attention has been devoted to lesions of the larynx dependent upon typhoid infection. Wishart¹ has reported a case which became affected with laryngeal stenosis during convalescence, and when almost moribund required tracheotomy because of the interference with respiration. Ulceration of the left vocal cord was found, with abductor palsy of the larynx. The patient ultimately recovered. This case resembles many of those previously referred to from the fact that the laryngeal symptoms first became manifest after convalescence had set in.

TYPHOID PLEURISY was well exemplified in a case reported by Gordinier and Lartigau.² The patient was a physician, aged fifty-seven years, who had previously had an attack of typhus and one of typhoid fever. The latter infection occurred in his forty-third year, and was apparently severe, as it lasted for four months. The attack in which he was observed was accompanied by constipation, pains in the joints and muscles, colicky pains in the abdomen, cyanosis, hurried respirations, and a pulse that was small, irregular, and rapid. He had a double mitral lesion and congestion of the lungs, which, of course, explained some of the above symptoms. Later in the course of the attack right-sided pleural effusion was found, and two quarts of greenish fluid was drawn, which gave a pure culture of *B. typhosus*.

ABSCESS OF THE LUNG AND EMPYEMA. Two interesting cases of abscess of the lung and empyema occurring in brothers suffering from typhoid fever are reported by Sidney Phillips.³ Both cases had sore-throat, with glandular enlargement, shortly before their admission to the hospital for typhoid fever. At autopsy there were found in both cases healing or healed typhoid ulcers. In only one does bacteriolog-

¹ Philadelphia Medical Journal, September 7, 1901.

² American Journal of the Medical Sciences, January, 1901.

³ British Medical Journal, February 23, 1901, p. 453.

ical examination of the pus from the pleura seem to have been made, and in this case streptococcus lanceolatus was found alone.

JAUNDICE, CHOLANGITIS AND CHOLECYSTITIS. Three interesting cases of jaundice in the course of typhoid fever have been reported by George Ogilvie.¹ These cases were peculiar from the fact that the jaundice persisted throughout the whole course of the disease, and that in spite of its presence all three of the patients recovered. The first case was noteworthy from the fact that anorexia, nausea, vomiting, and jaundice were either coexistent with or possibly preceded the elevation of temperature. With the decline in temperature the jaundice also gradually diminished. In the second case, also, the jaundice was early in the time of its onset, having begun at the end of the first week of the infection. In this case, also, the discoloration of the skin and mucous membrane disappeared as the temperature fell. The third case had been given anti-typhoid serum, with subsequent reaction in August of 1899. In spite of this, during the following April, after an attack of jaundice, symptoms of typhoid fever developed, and his jaundice did not disappear until long after infection ceased. The evidence of typhoid fever in this case is chiefly from hearsay, and would seem rather questionable. A fourth case is briefly narrated where jaundice occurred in the second week of a typhoid infection. In this case a round-worm, stained with bile pigment to an extent of one-third of its length, was passed by the bowel, and the jaundice was supposed to have been due to obstruction of the common duct by the parasite. The author draws a brief but interesting parallel between his cases and the group of symptoms usually called Weil's disease. He concludes that in these cases the jaundice is due to some direct action of the typhoid toxin on the liver or bile channels.

The occasional occurrence of cholangitis and cholecystitis during the course of or subsequent to typhoid fever, and the undoubted connection between this infection and the subsequent biliary calculi, make a contribution by Dalglish² worthy of note. In Bloemfontein he treated one hundred cases of jaundice. At the same time there were many other cases presenting the same symptoms under the care of other practitioners, while acute dysentery and typhoid fever were both epidemic in the town. All three conditions (dysentery, typhoid fever, and jaundice) increased together and subsided at the same time. He notes many instances of the association. In one family the father had dysentery, the son and daughter typhoid fever. In another family the husband had typhoid fever and the wife had jaundice. In another family the mother was

¹ British Medical Journal, January 12, 1901, p. 75.

² Lancet, August 24, 1901, p. 523.

jaundiced, while a child had typhoid fever. The jaundice came on gradually, with dull headache and malaise, but no fever. Owing to the simultaneous occurrence of the jaundice with the typhoid fever he believes, without offering proof of his theory, that the jaundice was in some way due to the typhoid bacillus.

An interesting article upon typhoidal cholecystitis has been contributed by Joseph H. Pratt.¹ Five cases are reported where the inflammation of the gall-bladder occurred as a complication of typhoid fever, or where infection by the typhoid bacillus at some time had something to do with the gall-bladder trouble. The first case which he reports died in the fifth week of typhoid fever from intestinal hemorrhage. There were no symptoms during life of infection of the gall-bladder, yet at autopsy the bile was found to contain great clumps of the bacilli of Eberth. The second case which he reports was in bed and in the third week of typhoid fever, when sudden abdominal tenderness with distention caused the suspicion of a perforation. Laparotomy revealed no evidence of the latter, but the gall-bladder was found to contain dark bile, with some pus. In the bile so obtained typhoid bacilli were found. The third case had a sudden severe pain in the epigastrium and right hypochondrium on the seventeenth day of an attack of typhoid fever. Operation was performed for suppurative cholecystitis, and on opening the gall-bladder bile and creamy pus escaped, together with a number of small gallstones. Pus from the gall-bladder and from the nuclei of two of the gallstones showed on culture a pure growth of typhoid bacilli. In the fourth case there was no history of any previous typhoid fever, and the patient was admitted for severe abdominal pain of hepatic origin. Operation was performed, and a purulent collection, containing 218 gallstones, was removed from the thickened gall-bladder. From the liquid contents of the gall-bladder typhoid bacilli were obtained in pure culture. The patient died on October 19th, yet three months after, although the stones had been kept in a hot, dry room for all of that time, pure cultures of typhoid bacilli were obtained from the centre of two out of ten stones examined. The fifth case was somewhat similar in the absence of history of typhoid fever and the presence of acute gangrenous cholecystitis, with localized peritonitis, both caused apparently by infection with typhoid bacilli.

A case of typhoid fever complicated by cholecystitis on the seventh day of a relapse has been investigated bacteriologically by Brion.² The contents of the gall-bladder showed a pure culture of typhoid bacilli, although the culture was made at autopsy performed twenty-seven hours

¹ American Journal of the Medical Sciences, November, 1901, p. 584.

² Centralblatt f. Bakt., Parasitenk. u. Infectiönsk., September 30, 1901.

after death. It is mentioned here partly in order to note the occurrence of this additional case of typhoid fever complicated by involvement of the biliary apparatus; partly, also, because it is rather curious that the bacillus should be found in pure culture when autopsy was made at so long a time after death.

Hamilton¹ has reported four cases of cholecystitis occurring as a complication of the disease.

ORCHITIS AND EPIDIDYMITIS. In former volumes of *PROGRESSIVE MEDICINE* the occurrence of orchitis and epididymitis as a complication of typhoid fever has been noted. During the last year two new cases of this complication have been noted by Kinnicutt² as occurring in a series of 889 cases of typhoid fever. He concludes that this rare complication of the disease develops late in its course or even during convalescence, usually terminating in resolution, although suppuration occurred in 25 per cent. of the cases.

HEMORRHAGIC PANCREATITIS. A case is reported by Chauffard and Ravaut³ wherein hemorrhagic pancreatitis is supposed to have occurred in the course of an attack of typhoid fever. The patient was seen from the beginning of the attack. Defervescence occurred on the nineteenth day. On the fifty-second day, while well along in convalescence, there was a sudden onset of pain in the right hypochondriac region, with distention of the abdomen and other symptoms pointing to the occurrence of perforative peritonitis. For a little time the condition improved, but high pulse, dyspnoea, and bronchopneumonia were followed by death. At autopsy there was found no evidence of perforative peritonitis. The report states no fat-necrosis was present, but that the pancreas was adherent to neighboring organs and was surrounded with hemorrhagic cellular tissue. The hemorrhage was found to be, in the main, periglandular. The islands of Langerhans showed marked swelling, but the authors state that this change has been noted by them in all cases of typhoid examined. There was no evidence of true inflammation of the pancreas, nor were there degenerative changes except for the hemorrhagic infiltration. They believe the change in the pancreas to have been due to congestion of its veins. From the examination of this and other cases of typhoid fever the authors conclude that the follicles of Langerhans play a protective rôle in this as well as in other infections. While the case is reported as one of hemorrhagic pancreatitis occurring in the course of typhoid fever, the description given would hardly warrant the conclusion that the former was the actual lesion present.

¹ Montreal Medical Journal, December, 1900.

² Transactions of the Association of American Physicians, 1901.

³ Archives de Méd. expérimentale et d'Anat. pathologique, March, 1901.

HÆMOGLOBINURIA complicating typhoid fever is of such extreme rarity that the report of a case by Musser and Kelly¹ requires notice. A colored man, aged twenty-one years, in the course of a typical attack of typhoid fever showed, on admission to the hospital, a large quantity of albumin, with granular casts and hæmoglobin (without erythrocytes) in the urine. Examination of the blood showed marked anæmia of the chlorotic type, the red blood cells being 1,950,000; leucocytes, 8960; and the hæmoglobin 15 per cent. The condition of the urine persisted for ten days, when the hæmoglobin disappeared from the urine, and thereafter the blood slowly returned to the normal and the patient recovered.

DIFFUSE GANGRENE OF THE SKIN as a complication of typhoid fever was mentioned last year in connection with Stahl's series of cases of this peculiar complication. Another instance has been reported by Abt² which presented other features of interest that are worth noting. The case was a female child, aged twenty-one months. It died after seventeen days of severe infection, with tense abdomen and marked œdema of the extremities and face, although the urine was negative. On the back of the neck and extremities there was a peculiar eruption of papules, some of which soon became pustular and left behind them areas of gangrene. Autopsy was performed, and there were found the ordinary early lesions in the intestines, without ulceration, pin-point areas of necrosis in the liver substance, cholangitis, adenoma of the liver, and the gangrenous patches of the skin which had been present during life.

PHARYNGEAL DIPHThERIA AND TYPHOID FEVER. This association has been occasionally noted, and while the occurrence is probably a purely accidental one, it is possible that the typhoid fever may have some influence in favoring diphtherial infection and the violence of the diphtheritic manifestations through the lowering of the vitality produced by it. Morris Manges³ mentions four cases of this association from the literature, and reports six cases under his own observation, five of the latter having recovered and one having died. In his article he also calls attention to the curious ulcerations of the pillars of the fauces, which are of frequent occurrence in typhoid fever, which have nothing to do with the diphtheritic infection, and show on bacteriological examination no definite and specific characters leading to the certain conclusion that they are due to the direct action of the typhoid bacillus.

Another case of the association of typhoid fever and diphtheria has

¹ Philadelphia Medical Journal, January 19, 1901.

² Journal of the American Medical Association, August 17, 1901, p. 445.

³ American Medicine, June 1, 1901.

been contributed by Mason.¹ A white female, aged six years showed on the second day of her illness a small patch on the left tonsil, followed by a similar appearance on the right side. Culture from the patches showed a pure growth of the Klebs-Loeffler bacillus, and 2000 units of antitoxin, given in two doses, caused the disappearance of the patches. After this a typical course of typhoid fever was run, and the patient recovered.

The association of these two infections is also referred to under the heading of Diphtheria.

SPONDYLITIS TYPHOSA. Two years ago a considerable amount of space in the corresponding volume of *PROGRESSIVE MEDICINE* was devoted to this question. Within the past year another case has been reported by Kühn.² Symptoms of the involvement of the spine began on the eighty-third day of the disease and the thirtieth day after the temperature had reached the normal point. At first there was simply obscure pain in the left lumbar region. This, however, increased, so that six weeks later the lumbar region was distinctly tender to pressure, and compression of the spinous processes of the lower lumbar vertebræ gave distinct pain. The patient lay stiff and motionless in bed, because of the fact that the slightest motion gave rise to pain. If, however, he remained quiet no discomfort was present. The local symptoms gradually abated, the spinous processes became somewhat prominent, and a little over three months after the beginning of the pain there was distinct lumbar kyphosis, which persisted for a time, but eventually disappeared. The ultimate result was a complete return to the normal. The treatment employed was the local application of ice and enforced rest on the back. The late appearance of the vertebral symptoms in this and in many other cases reported is worthy of mention. There have now been reported a sufficient number of cases to make it important that in every case of dorsal pain following even some time after an attack of typhoid fever, spondylitis of typhoid origin should be suspected and investigated. The favorable result of rest may be supposed to be more perfectly obtained when early treatment is adopted, while the neglect of this measure may mean permanent disability which might have been entirely avoided.

Another case of typhoid spine where the evidence was distinctly in favor of a true pathological inflammatory lesion has been reported during the past year by Taylor.³ In this case the pain in the back began a few days after the patient got out of bed after an attack of typhoid fever lasting for nine weeks. The pain was in the lumbar region. Slight prominence of the spine to the right of the sacrum and in the

¹ *American Medicine*, August 31, 1901, p. 320.

² *Münchener med. Wochenschrift*, June 4, 1901.

³ *Philadelphia Medical Journal*, December 28, 1901.

lumbar region was noted. The slightest movement, especially one involving torsion or other movements of the spine greatly increased the pain. The posterior deformity was very distinct. After two months the pain gradually grew less, the thickening disappeared, and the rigidity became less marked. The cure appears to have been permanent. Taylor draws attention to the fact that this undoubtedly was a case not of neurasthenia following typhoid fever, but of true inflammatory vertebral trouble.

TYPHOID ARTHRITIS AND OSTELITIS. While infection of joints in typhoid fever occasionally occurs, it is so unusual that the report by Barjon and Lesieur¹ of a case in which this complication occurred is worthy of being noted. The patient was a boy, aged seventeen years, who had had an attack of typhoid fever when eight years of age. A possible factor in the occurrence of the complication was found in the history of an attack of acute articular rheumatism six years before his second attack of typhoid fever. That this was a true attack of typhoid fever was proven not only by the presence of the Widal reaction on several occasions, but also by the cultivation of typhoid bacilli from the blood. The arthritis began in the feet and extended to the hands, and was accompanied by much delirium. The patient died, and at autopsy no ulceration of the bowels was found, and the free borders of the aortic and mitral cusps exhibited hard granulations, which were pink in color. The authors conclude that in their case the spleen and intestines were, so to speak, immune.

Hoedlmoser² has contributed an exhaustive article on typhoidal affections of the bones and joints, and has thoroughly reviewed the literature of the subject. He concludes that the prognosis is generally favorable unless there is a mixed infection; that abscesses should be evacuated early, and that trauma favors the development of the lesion. Among other interesting cases recorded is one where recovery occurred after the lapse of a year, and another which, after failure of other treatment with post-typhoid periosteitis, was apparently cured by the injection of antistreptococcus serum. In 50 per cent. of the cases the tibia was affected, the ribs being involved in about 30 per cent., the femora in about 23 per cent. In 38 out of 103 cases there was involvement of several bones, and in one case there was extensive necrosis of the sternum. The frequency with which the young are affected as compared with those of older years is shown by the fact that out of 68 cases 46 were under twenty-five years of age. It has, however, occurred between the ages of sixty and seventy years.

¹ *Journal de Phys. et de Path.*, March, 1901.

² *Centralblatt f. Grenzgebiete de Med. u. Chir.*, June 8, 1901.

CEREBRAL PRESSURE IN TYPHOID FEVER. Salomon¹ has made a very interesting series of observations regarding the signs and symptoms of this condition. He states that in a number of cases the optic nerves have, on ophthalmoscopical examination, shown evidence of the presence of increased intracranial pressure. This was not a distinct papillitis, but the disks were more or less veiled, the capillaries injected, and the edges of the disk indistinct, sometimes only on the temporal side. The veins were also somewhat dilated and tortuous. Lumbar puncture showed increased pressure in the cerebro-spinal serous cavities. The pressure amounted to from 180 mm. to 250 mm. of water. The fluid so obtained was always sterile and did not contain an excess of either albumin or leucocytes. In three cases the fluid failed to react to Widal's agglutinating test, although this was positive in the blood of the same patients. He gives three possible explanations of the cerebral symptoms that are present: 1. Purulent meningitis. 2. Direct toxic action. 3. Effect of the toxins upon intracranial exudation. In his own case the author believes that the latter cause for the brain symptoms was present. In all of his cases lumbar puncture was followed by subsidence of symptoms of brain pressure (such as headache), and in some of the cases the relief so obtained was permanent.

MUTISM. A very remarkable condition has been reported by Guttman² in a child aged seven years, in whom stupor appeared on the ninth day. When the physician came near to her bed she closed her eyes, blushed violently, and could not be persuaded to speak. This condition continued until the fifty-eighth day of the disease, when speech reappeared, only to again disappear until the sixty-third day, at which time she was for the first time free from fever. She at that time commenced to respond to questions by gestures. Four days later she was hypnotized, and suggestion was made that she would be able to speak as soon as an electric battery was heard. From that time speech returned, and did not again disappear. Apparently it was simply a case of mutism, and while it evidently had hysterical characteristics, none of the ordinary hysterical stigmata were present.

DELIRIUM. Dieters³ has reported two interesting cases of typhoid fever occurring in a brother and sister whose father was an imbecile and whose mother was insane. In both cases delirium existed before elevation of temperature occurred. The brother, aged twenty-five, was a mental degenerate, and for two days before his temperature rose was maniacal, growing calmer when fever appeared. The Widal test was

¹ Berliner klin. Wochenschrift, 1900, No. 6.

² Deutsch. Zeitschrift f. Nervenheilkunde, 1901.

³ Münchener med. Wochenschrift, November 20, 1900.

positive, and the patient recovered. His sister, aged seventeen years, was maniacal for three weeks, when fever with albuminuria and progressive weakness appeared, followed by sudden death. At autopsy typhoidal lesions were found. It is probable that the inherited instability of mind in both patients, and the pre-existing mental degeneration in the brother, had much to do with the prominence of the mental symptoms.

TYPHOID NEURITIS. Last year a valuable communication from Vincent in regard to the effect of typhoid toxin upon the sciatic nerve when injected in the neighborhood was referred to in the corresponding volume of *PROGRESSIVE MEDICINE*. In connection with this it is interesting to notice a report by H. J. White¹ concerning two cases of localized neuritis occurring in the course of typhoid fever. His first case was running the usual course of typhoid fever when pain appeared at the inner side of each elbow, radiated along the ulnar side of the forearms, and extended to the ulnar side of the ring fingers. The pain was of a sharp, shooting character. Both legs were slightly swollen and showed tenderness of the muscles of the calf; but they, at the end of two weeks, had returned to the normal condition. In the arms, however, the pain continued, and the fingers became stiff and useless, with atrophy of the interosseous muscles, inability to completely extend the fingers, with strong flexion of the little finger, abduction of the thumb, and anæsthesia (sensory and thermic), with analgesia of the ulnar side of the hand, both sides of the little finger, and the ulnar side of the ring finger. The left hand was affected to a less degree than the right. In the second case the condition was more like the ordinary tender toes, which are not extremely unusual. In this case the hyperæsthesia and hyperalgesia were present at the top and the bottom of the toes. Thermic sense was normal, the plantar reflexes were absent, but the knee-jerks were normal.

PYELITIS. A considerable amount of space was devoted last year to typhoid bacilluria and typhoidal cystitis. It is probable that the infrequency of nephritis and pyelitis as complications of typhoid fever is explained by the theory advanced by Horton Smith, that many of the bacilli found in the urine are due not to excretion of large numbers of bacilli through the kidney, but to multiplication in the bladder of a few micro-organisms which have escaped from the body through the renal tissues. Garnier and Lardennois² state that only three cases of pyonephrosis in typhoid fever have been observed in France, and in their paper a fourth case is reported. This occurred in a man, aged

¹ Philadelphia Medical Journal, January 19, 1901.

² Presse Médicale, April 13, 1901.

thirty-one years, with a moderately severe infection. Pain was noticed in the left hypochondrium, and this persisted after defervescence, and was accompanied by an occasional transient febrile paroxysm. One month later the pain became more severe, and radiated from the loin to the testicle, simulating renal colic. This was accompanied by the expulsion of a few thick masses of pus containing typhoid bacilli. Nephrotomy was performed; but, the pus still continuing in the urine, the kidney was removed and found to be dotted with abscesses. The patient, however, died from progressively increasing cachexia, and at autopsy the right kidney was found to be in the same condition as the left. They state that nephrotomy should be done early and the kidney should be extensively opened, while if the affection progresses and the other kidney becomes attacked nephrectomy is indicated. The communication is one of much importance as pointing to the fact that occasional typhoidal bacilluria is indicative of local infection of a portion of the urinary tract more important than the bladder. In this connection I recall a case that interested me extremely, although it came under observation before Eberth's bacillus was thoroughly well recognized as the cause of the disease. I am reminded of it by the communication just cited. In this case, after a grave attack of typhoid fever, the patient died with apparent pyæmia, but at autopsy the kidneys alone were found sprinkled through their substance with minute, almost microscopic, abscesses.

Perforation in Typhoid Fever. The absence of the text-book symptoms of perforation in typhoid fever is well illustrated by a case reported by Thornton and Godman.¹ A woman, aged twenty-seven years, was seen on the twelfth day of the attack. Fifteen days after the temperature had fallen to the normal a well-defined relapse set in. On the eighteenth day of this relapse perforation occurred. The symptoms indicating this were colicky pains in the right lower quadrant of the abdomen, a rise of three degrees in the temperature, quickening of the pulse, thoracic respiration, disappearance of liver dulness, and a scaphoid condition of the abdomen. Pain and the disappearance of the liver dulness are in reality the only two symptoms in this description which would at all resemble those usually described as indicative of perforation. The disappearance of liver dulness is, of course, recognized as being a sign of but little value, inasmuch as liver dulness is frequently perfectly preserved in this condition. The scaphoid abdomen is exactly the reverse of the condition ordinarily described in the text-books as showing the existence of perforation. Operation in this particular case was performed two hours after the onset of the symptoms. There was

¹ Lancet, August 17, 1901.

no peritonitis, but a perforated ulcer was found three inches from the ileocaecal valve. The patient died eight days after the operation, from the effects of the fever, the autopsy showing the bowel to be healing well.

Allyn¹ has reported a case where perforation was not shown at the operation, but in which this was found at autopsy, together with a perforation of the colon and gall-bladder.

Russell² reports six cases of perforation in typhoid fever showing the extreme variability of the leucocyte-count in typhoid fever. Even where no complication existed the leucocyte-count sometimes reached 15,000, while he draws attention to the fact, which of course is well known, that many complications, even though slight, may be the cause of leucocytosis instead of leucopænia. He concludes, however, that when pain and tenderness in the abdomen come on suddenly, with leucocytosis not otherwise perfectly explained by definite complicating lesions, incision is indicated with a view to closing the perforation.

Perforation in typhoid fever is also the subject of a paper by Osler.³ In order to show the indefinite character of the symptoms indicative of perforation three cases are related. In one of these pain, tenderness, muscular rigidity, distention, and movable dulness were present, but there was no fall of temperature, no increase in the leucocytes, no marked rapidity of the pulse, and no collapse. Operation was performed, and the perforation was sutured, but the patient died after the ulceration had almost healed. No peritonitis was found. In the second case hemorrhage was present with the perforation, and all the symptoms pointed to the former accident as being responsible for their appearance. This patient was operated upon, but owing to the necrotic condition of the intestinal wall sutures would not hold, and the patient died on the table. The third case is also cited to show the variability of symptoms. This patient was a child who was operated upon eight and a half hours after the occurrence of perforation, the operation being followed by an uneventful recovery. Osler again urges what has been previously brought forward prominently, that the typical text-book symptoms—such as sweating, Hippocratic facies, feeble running pulse, collapse, etc.—are symptoms not of perforation, but of the peritonitis which accompanies perforation. Osler again urges what Cushing a few years ago also strongly advocated, viz., early association of the physician and surgeon in caring for typhoid patients.

The propriety of operative interference in cases of perforation occurring in the course of this disease makes a close analysis of all of the

¹ Philadelphia Medical Journal, August 3, 1901.

² Boston Medical and Surgical Journal, April 18, 1901.

³ Philadelphia Medical Journal, January 12, 1901.

conditions likely to aid us in detecting this a matter of extreme importance. It will be recalled that last year, in reviewing the article by Shattuck, Warren, and Cobb,¹ abdominal pain was particularly emphasized as a premonitory symptom of the occurrence of perforation. During the past year an interesting article has appeared by McCrae² upon the subject of abdominal pain in typhoid fever. Five hundred cases showed that in 41 per cent. there was no pain or tenderness at any time. In 222 cases abdominal pain was present. In 61 cases pain was present only at the outset, while in 161 cases it was present during the entire course of the disease. These 161 cases he divides into the following classes: 1. Pain due to conditions other than the lesions of the disease (hysteria, pulmonary troubles, abortion, etc.). This class comprises 15 cases. 2. Conditions in the intestinal tract not classifiable as complications (vomiting, constipation, diarrhoea, etc.). This class comprises 31 cases. 3. Abdominal conditions other than the specific bowel lesion (appendicitis, hepatic abscess, painful spleen, phlebitis, peritonitis, etc.). In this class there were 25 cases. 4. Pain due to the specific intestinal complications (hemorrhage and perforation) occurred in 27 cases, while in 70 cases no discoverable cause was present.

Preventive Measures. The subject of the conveyance of typhoid fever is still exciting discussion, especially in regard to the ability of the infection to occur through the atmosphere. Canney³ concludes that the evidence of air-borne typhoid fever is not established, and that the evidence in South Africa and Egypt is opposed to the theory of such a means of infection. He also states that the evidence in South Africa and Egypt point clearly to its being water-borne, and if the water-supply is prevented from infection there is no other means for active spread. He considers that the theory of spreading from flies and dust is so far only a matter of conjecture. It would certainly seem, however, that in regard to this last point a sufficient amount of work has been done to prove that insects may mechanically convey the bacillus from the stools of those infected to the food-supply. Some of the facts in support of this were cited in *PROGRESSIVE MEDICINE* last year. They would seem to come as near to proof as is possible under the circumstances.

The importance of preventive measures against the contraction of typhoid fever by troops in the field cannot be overestimated, particularly in view of the recent experience of the United States and of England in their wars with Spain and the Boer Republic respectively. Among other measures for disinfecting water suspected of being the carrier of

¹ *PROGRESSIVE MEDICINE*, March, 1901, p. 190.

² *New York Medical Journal*, May 4, 1901.

³ *British Medical Journal*, August 24, 1901.

typhoidal infection, Parks and Riedal¹ recommended the use of sodium bisulphate in the form of 5-grain tabloids made up with the smallest possible quantity of gum arabic, so that it would dissolve at once in water. They found that the bacillus typhosus was killed after five minutes' contact with the solution of sodium bisulphate in the proportion of a grain to a pint of infected water. They recommend, however, that it is better for the water to be treated for fifteen minutes in order to make assurance doubly sure. They state that the salt is not laxative in doses smaller than one-quarter of an ounce.

TYPHOID BACILLI IN THE URINE. In previous volumes of *PROGRESSIVE MEDICINE* it has been necessary to devote a considerable amount of space to the question of excretion of typhoid bacilli in the urine. It is now clearly recognized that not only are they frequently present in this fluid, but that the urine may play an extremely important rôle in the dissemination of the disease. Gwyn² has studied the subject of typhoid bacilluria from the stand-point of prevention. He believes that the bacilli are present in urine in from 20 to 30 per cent. of the cases of typhoid fever, and that when present they are in pure culture, and may be so numerous that each cubic centimetre may contain 500,000,000 micro-organisms. He concludes that they usually appear in two or three weeks, and that they may persist in the urine for months or years after the attack of typhoid fever has subsided. The correctness of this conclusion is seen by many of the cases of typhoidal cystitis reported during the last few years, in which years after the attack of the constitutional infection these micro-organisms have been found in the urine. In order to arrive at some definite knowledge of the best way of preventing such a means of spread of typhoid fever, Gwyn experimented with various substances as disinfectants. Milk of lime was found to be unsatisfactory in that it was slow and ineffective and required a very large quantity to have any action. Carbohc acid was found to be an efficient disinfectant, but to be slow and to require the use of large amounts. Corrosive sublimate was found to be both powerful and rapid as a disinfectant, as was also formaldehyde. The expense of the latter would prevent its being used in practical work as a disinfectant. Chlorinated lime and the chlorides of zinc, copper, and aluminum were also found to be efficient. As is well known from the work of Mark Richardson and of many others who have followed his line of work, urotropin administered by the mouth is an extremely efficient means for ridding the urine of micro-organisms. So efficient is it, and so frequently present are the typhoid bacilli in the urine, that it

¹ *Lancet*, January 26, 1901, p. 242.

² *Philadelphia Medical Journal*, January 12, 1901, p. 81; and *Johns Hopkins Hospital Reports*, vol. viii.

might be well to consider the propriety of in every case administering urotropin for a week or two during the post-febrile stage of the disease before the patients are strong enough to leave the hospital.

Allbutt¹ has noted a number of cases of typhoid fever undoubtedly resulting from infection transmitted through the urine. He urges, therefore, its disinfection by the administration of urotropin before the patient is allowed to mingle with his fellows.

Neufeld² found typhoid bacilli in the urine in three cases out of twelve examined. He states that the bacilluria is apt to appear very suddenly, to be unaccompanied by disturbances in micturition, and to have no relation to the presence or absence of albumin in the urine. He notes, as have others, that the bacilli are seldom found in the urine before the end of the second week, and sometimes not until convalescence is established. He agrees with the others that urotropin rapidly causes a disappearance of the bacilli from the urine, but points out the fact that its administration does not prevent reinfection of the urine. He advises that the drug should be administered until the patient has been convalescent for four weeks.

“VACCINATION FOR TYPHOID FEVER.” During the past year a large number of contributions have been made regarding the use of so-called vaccination for typhoid fever. A few of these only can be mentioned as showing the value of the procedure. In an article upon antityphoid serum Walker³ reviews Ehrlich's observations, with his theories of immunity. He emphasizes the necessity for the distinction between sera which destroy microbes and those which are antitoxic, or, in other words, the bactericidal as opposed to the purely antitoxic materials. The former, of course, at times may possess not only bactericidal, but antitoxic power. The conclusions at which he arrives are as follows: 1. A serum with antimicrobial and antitoxic power can be obtained by immunizing horses against the *B. typhosus*. 2. The initial stage may be shortened by the use of the method of Bekenham. 3. A high degree of immunization must be obtained, and the employment of living cultures in the later stages is desirable. 4. The serum must be made as widely available as possible by using many different races of the *B. typhosus*. 5. The relative value of serum may be determined by its relative power of causing agglutination.

Caley⁴ gives the results of the inoculation of those connected with the Red Cross Hospital in South Africa. Three sections of the members of the staff and others were inoculated. The first section was composed

¹ British Medical Journal, July 13, 1901.

² Deutsch. med. Wochenschrift, December 20, 1900.

³ Journal of Pathology and Bacteriology, 1901, vol. vii. p. 250.

⁴ British Medical Journal, January 12, 1901.

of 61 persons. Of these 61 all except four were inoculated twice, at intervals of ten days, on the voyage outward. Two of the nurses having had typhoid fever before were not inoculated. Two orderlies were inoculated only once. Although they were in a hot-bed of typhoid fever in Kroonstadt and Bloemfontein, not a single case occurred in this first section of the Red Cross Hospital. In the second section of the hospital there were 82 persons, all of whom were inoculated on ship-board, but many only on one occasion, and all of them with material that was less fresh than was that used in the case of the first section. Out of 36 nurses in this section but one had typhoid fever, and she was the only one who had not been inoculated. Five orderlies in this section had the disease, and two of them died. Of the five, two had been inoculated, but three had not. Of the two that died one had been inoculated once, the other had not been inoculated. From the observation of these two and one other group, Caley concludes that the evidence which he brings forward is strongly in favor of the value of inoculation, and that if it is not always preventive, the attacks are certainly milder than when this measure is not employed.

Wright¹ reports a remarkable series of results from inoculation for typhoid fever among the Fifteenth Hussars in India. In those that were inoculated typhoid fever occurred in only 0.55 per cent., while in the uninoculated the morbidity from the same cause was 6.14 per cent. The mortality in the inoculated was 0.27 per cent. as compared with the mortality in the uninoculated, which reached 3.35 per cent.

McLaughlin² relates the experience of Wright among the British Army in India during a period of nine months: 11,295 men were observed. Of these 2835 were inoculated; 8460 were not inoculated. Among the inoculated 27 (0.95 per cent.) contracted typhoid fever. Among the non-inoculated 213 (2.5 per cent.) contracted the disease. Of the cases inoculated 5 cases died (a mortality of 0.2 per cent.), while among the uninoculated 23 died (a mortality of 0.34 per cent.).

Wright³ summarizes the results obtained by inoculation for typhoid fever in Egypt and Cyprus during the year 1900. During this period there were 2669 uninoculated troops; 720 inoculated. Among the uninoculated 2.5 per cent. developed typhoid fever, with a death-rate of 0.4 per cent. The incidence of the disease among the inoculated was 0.14 per cent., the death-rate 0.14 per cent.

Cullman⁴ gives the result of antityphoid inoculation at Richmond District Asylum. Among 655 individuals 511 were inoculated.

¹ British Medical Journal, February 9, 1901.

² Medical News, March 2, 1901.

³ British Medical Journal, May 4, 1901.

⁴ Dublin Journal of the Medical Sciences, 1901.

Among those inoculated only 7 individuals were attacked with the disease; whereas, among the 144 not inoculated there were 47 cases of typhoid fever.

The changes in the blood produced by antityphoid inoculation have been studied by Wright.¹ Where well-marked constitutional symptoms followed inoculation he found, first, that the bactericidal power of the blood decreased and the susceptibility to typhoid fever increased for a period of about two or three weeks, but that then the bactericidal power increased and the susceptibility lessened; and, second, when very severe symptoms were produced the negative phase of susceptibility might be produced and never give place to the positive phase of increased resistance. He therefore concludes that the antityphoid material should be only employed in small doses, and ought always to be followed by a second inoculation. He also concludes that there appears to be a definite limit beyond which the bactericidal power of the blood cannot be increased by inoculation with sterilized cultures of typhoid bacilli.

An interesting question in relation to the agglutinating phenomenon seen after so-called vaccination against typhoid fever is the behavior of the blood-serum of those so inoculated toward living cultures of the typhoid bacilli. A preliminary report upon this question was made by Andrewes Schölb² before the Pathological Society of London. After inoculation of animals with broth cultures of typhoid bacilli the first agglutination occurred from the fifth to the sixth day after inoculation.

Treatment by Organic Extracts. In the volume of *PROGRESSIVE MEDICINE* for March, 1900 (p. 186), reference is made to the use of extracts of organs from animals previously inoculated with typhoid bacilli, as advocated by Jez. This author has contributed another article upon the same subject.³ After describing the method of its preparation (as was noted in this work in 1900) Jez confirms his previous statement in regard to the beneficial action of the extract, and states that the temperature-curve was lowered, the duration of the disease was lessened, and the pulse strengthened. On the other hand, greater prominence of the rash and larger size of the spleen were noted in those cases where the extract was used as compared with other cases. Eichhorst⁴ reports twelve cases treated successfully by means of Jez's typhoid extract. All the cases were severe, and were in the second week of the disease when the organic extract was used. All of the cases survived; the temperature reached normal in from five to seven

¹ *Lancet*, September 14, 1901.

² Abstract in *British Medical Journal*, February 9, 1901, p. 343.

³ *Wiener klin. Wochenschrift*, January 24, 1901.

⁴ *Therapeut. Monatshefte*, October, 1900.

days. Their general condition improved quickly, and as the temperature fell delirium ceased. The extract was used in two cases with relapse, and in both of these recovery occurred. The number of cases treated by Jez's method is too small to do anything more than confirm the work done by the originator. Eichhorst's results, however, make it important that the treatment of typhoid fever by this extract should be still further investigated by others. The great disadvantage of the use of the extract would seem to be its expense and the care necessary in its preparation.

Sequels. **PALSY OF THE PALATE** following typhoid fever is reported by Stuart.¹ Without apparent throat symptoms the patient, on the forty-ninth day after admission to the hospital, was noticed to have a nasal voice. On the next day food was returned through the nose. Later, about half a month after this, numbness was present in the fingers and toes and in the calves. It was followed later by a claw-like condition of the fingers. Evidently, therefore, the patient had multiple neuritis involving the nerves of the palate as well as those of the upper extremities.

ABSCCESS OF THE LIVER. A very rare sequel of typhoid fever is abscess of the liver, a review of the literature of which has been furnished by Emile Cassuto.² He makes two varieties—the large, solitary abscess, similar to that occurring in certain cases of dysentery, and the small, multiple abscesses scattered throughout the substance of the organ. He states that in cases of this complication or sequel the pus is always fetid and gangrenous, and may contain either *B. typhosus* alone or a mixture of this and other organisms.

BUBONIC PLAGUE.

Vitality of the *Bacillus Pestis*. An important point in regard to the prevention of the spread of the plague is, of course, the question of the resisting power of this micro-organism. On this account the report of Rosenau³ is of value. In order to investigate the question, organisms were obtained from seven different sources. Various materials, such as food, water, sawdust, wood, flannel, garden earth, and other materials were inoculated with pure cultures of the *bacillus pestis*. As he points out, the conditions were not perfectly in accordance with the natural growth of the bacilli, inasmuch as the spores used had been

¹ British Medical Journal, March 2, 1901, p. 514.

² Paris Thesis, 1899–1900, No. 626; Abstract in *Gaz. hebd. de Méd. et de Chirur.*, January 6, 1901.

³ Bulletin No. 4, Hygienic Laboratory, U. S. Marine Hospital Service.

somewhat accustomed to a saprophytic life through test-tube cultivation, while the objects which were inoculated for the experiments had been previously sterilized, so that the ordinary saprophytes could play no part, as they might in more natural conditions. He found that food products aside from milk and milk products were little favorable for the perpetuation of the bacilli. The latter were found not to live long on the surface of dry objects at temperatures above 30° C. In rice they were found alive after the lapse of eighteen days, but other articles of food were found to be less favorable to their life. In water it was found that a trace of organic matter enabled the bacillus to remain alive for 116 days when the water was preserved at low temperatures (17° C. to 19° C.), while it was only able to live for six days at 37° C. It was found that temperature, as would be expected, had a great effect on the vitality of the organism. Temperatures of 70° C. were found to be invariably fatal in a few minutes. However, it was found that in the cold they could be kept alive for three or four months, even though dry, but that if it were moist they would live for a very long time in albuminous media at 37° C. It would seem that from these experiments plague should be a disease of cold climates, a condition that is not borne out by clinical observation. In the tropics, however, other more direct methods of spreading the disease have greater scope. The available moisture was found to have a decided influence, especially if combined with proper temperature. With moisture present the organism can be kept alive for a very long time under conditions which would shortly terminate its existence if it were dry. The effect of sunlight was found to be very marked, so that he makes the statement that "objects may be sufficiently disinfected on the surface by exposing them all day to a bright sun, provided the temperature in the sun is above 30° C." Dryness was found to have a great effect in killing micro-organisms in soil and on merchandise. Clothing contaminated with discharges kept in a cool place was found to harbor the bacillus of plague for months, while it was found that on paper the bacillus rapidly died—an important point in regard to the transmission of the disease through the mails. His experiments showed that both formaldehyde gas and sulphur dioxide were fatal to the bacillus pestis as these agents are usually employed, providing the gas was able to penetrate to every portion of the material to be disinfected; and the author points out that sulphur dioxide is of especial value because of its destructive power over the higher forms of animal life, such as fleas, rats, and other animals, possibly important as carriers of the disease.

The hitherto announced statement that the bacillus of plague is a frail organism is shown to be but partially true by Rosenau's experiments, while his experiments in regard to the influence of low tem-

perature on the bacillus when dry and when moist is of much importance as showing the danger of conveying infection in cold climates by clothing, bedding, etc.

Schultz¹ found that in test-tubes the plague bacillus retained for a long time not only its life, but its virulence. Four old tubes were examined which had contained the organism for four years, three years and three months, two years and ten months, and one year and eight months respectively. From these old tubes new cultures were made. All showed growth in one or two days, and from all the secondarily inoculated tubes the plague bacillus was obtained, with its usual characteristics. Mice inoculated with them all died in from one to five days, the clinical, anatomical, microscopical, and bacteriological elements all showing that they were killed by the plague bacillus, pure cultures of which were obtained from the blood in every case.

Prevention. In the spring of last year Danyz published an article in which he claimed that he had discovered a certain bacillus (*B. typhi murium*) which was capable of causing epidemic disease among mice, and which on increase of this virulence could be made pathogenic for various species of rats. The same bacillus or allies of it had been previously found to be destructive to varieties of mice. Danyz increased the virulence of the micro-organism in the following manner: A bacillus fatal to mice was first cultivated in bouillon, in order that in sinking to the bottom the organisms might become accustomed to the absence of air. From this culture bacilli were placed in a collodion sac and kept for twenty-four or thirty-six hours in the abdominal cavity of a rat before being again planted in flasks of bouillon. After a subsequent growth on agar it was found that when mice ate bread or grain soaked in a suspension of the bacilli their pathogenicity for mice was greatly increased. The bacilli so obtained were then treated in the same way, substituting white rats for mice, then substituting successively gray and black rats as the subjects of his experiment. Danyz claimed that by this procedure he finally obtained a bacillus capable of preserving its virulence for a long time in anaërobic culture.

Arthur Krausz² has also experimented with the bacillus described by Danyz. Feeding experiments tried on different domestic animals showed that the bacillus was not pathogenic for them. He also found that rats fed on bread soaked in cultures of the bacillus did not produce infection in other rats, even if the cadavers were eaten. From his experiments in Budapest he considers that the bacilli were not at all pathogenic to the rats dwelling in that location. He tried feeding rats

¹ Centralblatt f. Bakt., Parasitenk. u. Infektionsk., February 21, 1901.

² Deutsch. med. Wochenschrift, May 3, 1901, p. 351.

in the canal with bread soaked in the cultures, but no dead rats were found later. Autopsy on rats fed in confinement showed no splenic enlargement, no alteration of Peyer's patches, and no bacilli in the organs or in the blood. This is quite a contrast to the results obtained by Danyz in Paris.

Rosenau¹ obtained for the Pasteur Institute cultures of the organism described by Danyz. He fed 115 rats with cultures of this material. Of these 115 rats 46 died. Most of the rats used were the gray rat and the tame white rat, but a few wild brown Norway rats were used. No difference was noted in the effects of the bacillus upon these different varieties, but the quantity of the poison taken had a decided influence in the result. Thus, of 27 rats starved for a day or two, and then given as much as possible of the cultures, all died within a week, while if a small amount were used but a few died. Thus, 70 rats were fed with the contents of four agar tubes, and only 7 died, although upon feeding them again upon very large quantities 9 more perished. The survivors of this group were then fed as freely as possible for a week without any effect. Rosenau therefore concludes that a large primary dose proves fatal, but that "a small dose is not only uncertain, but produces an immunity." The interesting point in all these experiments to which reference has been made is the question of the transmissibility of the disease from one rat to another. Rosenau believes that while the disease can be spread from rat to rat because of their cannibalistic habits, this method of spread must be variable. In Rosenau's experiments he failed to produce a spread of the epidemic through the feeding of rats with carcasses or organs from infected animals. This is an important point, because, as Rosenau points out, the fact that only those die that eat the virus would prevent this method of experimenting on rats from having any advantage over various chemical poisons that have been from time to time employed for their destruction. On the other hand, it would appear that the bacillus is harmless to man and to the various domestic animals. His conclusions, therefore, as are those of a considerable number of other writers on the subject, are unfavorable to its value as an exterminator of rats and check to the spread of plague.

Bronstein² found that the Danyz bacillus was entirely non-pathogenic to laboratory animals and to house pets, both when administered by subcutaneous injection and when administered by the mouth. He concludes from his experiments that the bacillus is pathogenic for rats and is capable of exterminating them. He found that cultures obtained

¹ Bull. No. 5, Hygienic Laboratory, U. S. Marine Hospital Service.

² Deutsch. med. Wochenschrift, August 22, 1901.

from the spleen of rats so inoculated were much more virulent than were those obtained from other organs and from the blood.

Klein¹ has found negative results in his experiments with Danyz's bacillus, except when the organism was directly inoculated into rats, and concludes that the expectation that this organism will prove of value in exterminating plague cannot be realized.

Kister and Koettgen,² on the other hand, have found the organism described by Danyz to be very pathogenic to rats, producing in them changes resembling those produced by the plague bacillus. They, however, differ from the latter organism in being shorter, narrower, and motionless, showing no polar staining and producing no gas in glucose cultures.

Prophylactic Inoculation. The protective value of prophylactic inoculation for plague is well shown in an article by Bannermann.³ The study of over 6000 cases of plague shows a mortality among the inoculated of 43.5 per cent., while among the uninoculated 73.7 per cent. died. That the protective action becomes effective quickly is shown by the fact that even in cases where the disease was evident at the time of inoculation or developed on the same day the case mortality was only 48.8 per cent., which is a decided improvement over the mortality rate in those not inoculated. As to the length of time during which protection lasts he states that "this is still undecided, but evidence is accumulating in India to show that apparently a good effect is still visible as long as eighteen months subsequent to operation." In regard to its preventing the onset of the disease, a table is given showing that among seventy-one persons who were inoculated eight attacks occurred, with a mortality of 37.5 per cent., while among the sixty-four not inoculated twenty-seven were attacked, with twenty-six deaths.

Plague Epidemic in Kobe and Osaka. An interesting article by Kitasato, Takaki, Shiga, and Moriya upon the epidemic of plague in Kobe and Osaka from November, 1899, to January, 1900, is made available for English readers through the translation by Rosenau, which has been published by the United States Marine Hospital Service. Several divisions of the subject have been made in treating of the disease, most of which require mention.

The first subject considered is the influence of the house rat in spreading the disease. Through the municipal authorities, rats both dead and alive were paid for when delivered to the proper persons. In this way in the two places mentioned 35,000 rats were examined. Of the 20,000 found in Kobe one-fifth of the rats were found infected with *B. pestis*, while in the 15,000 obtained from Osaka only one-tenth

¹ *Lancet*, August 17, 1901.

² *Deutsch. med. Wochenschrift*, May 2, 1901.

³ *Centralblatt f. Bakt., Parasitenk. u. Infectiönsk.*, June 24, 1901.

were infected. Of 291 dead rats found in Kobe, 61 contained the bacillus of plague, while in an epidemic at Osaka, among 200 dead rats which were found 23 were so infected. A study by these authors of the period of incubation shows that the pneumococcic form develops in from one to nine days, while the bubonic form would seem to take either six or seven days. Out of 64 cases 19 showed general symptoms before the buboes appeared. Plague carbuncles were found in 5 cases, and in 3 of these the carbuncle preceded the appearance of the buboes by two, four, and thirteen days, the plague bacillus being found sparingly in the superficial layers of the carbuncles and in considerable numbers in the deeper infiltrated parts of the surrounding tissues. Owing to the frequency with which, in the epidemic studied by them, cervical and submaxillary buboes developed, and the fact that in these cases the development of the buboes was secondary to a tonsillitis, the authors think that the tonsils were the point of entrance for the plague germs. In 3 of their cases primary changes were found in the tonsils, all three of them dying with septicæmia and with early cerebral symptoms. Thirteen cases of true primary plague pneumonia transmitted from one person to another were observed in Osaka. In the review of the literature of plague for the last year mention was made of the plan advocated by Havelburg,¹ viz., the prompt removal of the buboes. This was done in 13 cases of the epidemic under present consideration. Of these 13 cases 4 recovered. In the favorable cases the operation relieved pain, and the patients felt better. In the other cases no such effect was noted. They point out the necessity for early extirpation if benefit is to be expected. Yersin's plague serum was used in 12 cases. Of these only 1, apparently a severe instance, recovered after being given 270 c.c. of the serum between the fourth and fifteenth days of the disease. No ill effects were observed from the use of the serum, and in the majority of the cases the remedy was used so late that relatively unsatisfactory results proved nothing in regard to its value. Haffkine's prophylactic is apparently successful in preventing the disease among physicians and nurses, but one case having died, supposedly from having been infected before the prophylactic was given. Yersin's serum was used as a prophylactic in but two cases, but both of these had evidently already been infected. Shiga tried the following method of preventing the disease: Cultures were made of the bacillus and grown at 30° C. in the incubator for three days. One platinum loop of the bacilli was rubbed up with 1 c.c. of physiological salt solution. This suspension of bacilli in salt solution was then heated to 60° C. for thirty minutes, after which 5 to 10 per cent. of carbolic acid was added,

¹ PROGRESSIVE MEDICINE, March, 1901, p. 228.

and the mixture was allowed to stand for twenty-four hours. This was then administered as follows: The vaccine just described was mixed with equal parts of immune serum and was then given in doses of 1.2 to 2 c.c. After several days, when the reaction had disappeared, a dose of the vaccine alone of equal size was given. Forty-seven healthy persons were thus treated. Following the injection there was slight tenderness and tension over the point of inoculation, with sometimes slight elevation of temperature, slight headache, and chilly sensations. These reaction symptoms were very slight. No cases so inoculated developed the disease. It is recommended by the authors that during severe epidemics of plague still larger doses of the vaccine should be used or that three injections should be given in increasing doses.

PNEUMONIA.

Infective Character of Pneumonia. An interesting series of cases showing the infective character of pneumonia has been described by A. Hamilton Wood.¹ In one family the grandfather, mother, and child were successively taken with croupous pneumonia. In another house mother, father, and one child all died from the disease within two weeks. In another instance a mother contracted it from sleeping in bed with her child, who had croupous pneumonia. These seem to be true instances of infection, and not simple coincidences.

Statistics. A careful analysis of 500 cases of croupous pneumonia occurring in the Pennsylvania Hospital during the past three years has been made by Norris.² A marked increase in the prevalence of the disease far out of proportion to the growth of the city is noted. The general mortality was 25 per cent. Interesting analytical tables as to the occurrence of various symptoms, the site of the lesion, and other points in symptomatology are worthy of careful study. A few points of special interest are worth mentioning on account of their interest at the present time. Among the 18 cases in which jaundice was present as a complication, 11 died, which bears out the statement frequently made that jaundice is a symptom of unfavorable import in this infection. The pupillary inequality of which mention was made in last year's volume of *PROGRESSIVE MEDICINE*, March, 1901, p. 143, was studied by Norris, and it was found in 64 cases examined with this in view; inequality was seen only in 2 out of 33 cases where the upper lobe of the lung was involved.

An analysis of 120 cases of pneumonia coming to autopsy has been

¹ British Medical Journal, February 23, 1901, p. 455.

² American Journal of the Medical Sciences, June, 1901, p. 684.

given by Steven.¹ Of the 120 cases 94 concerned males, 26 cases concerned females. An interesting table is given in the paper on the ages of those males in whom it could be ascertained. The mortality is stated to be greater in males than in females between the ages of thirty-six and fifty-five years, but that on either side of these ages the mortality is greater in females. As would have been expected from such a study made in this climate, the greater number of cases occurred in January, March, and December. As regards the seat of the lesion, he found the right lung alone involved in 51 per cent. and the left lung alone in 33 per cent. In 69 cases the lesion was situated in one lobe; in 35 two or more lobes, while in 16 cases both lungs were affected. Most of the cases died at about the seventh day, although one died as early as the third day of illness, two others not until the nineteenth day. Most of the deaths occurred in the stage of gray hepatization, although 23 died in the red stage.

Serum Reaction. Giffon² found a characteristic clumping of pneumococci with the blood of patients infected by that micro-organism in 186 subjects, in some of whom pneumococcic infection had not been suspected before the agglutination test was applied. The pneumococci agglutinated in clumps resembling fragments of pseudo-membrane, which finally became cup-shaped.

Pneumococcic Peritonitis. Three cases of peritonitis due to infection with the pneumococcus are reported by Bryant.³ Pneumococci were found at autopsy in the heart-blood and in the peritoneal fluid in one case, while in the second this organism was found in the blood from the right ventricle, spleen, and pleura, while staphylococci were found in the peritoneal cavities. In the remaining case encapsulated diplococci were found in the peritoneal fluid. He classifies the pneumococcus peritonitis as primary and secondary. In neither of his cases were the lungs involved.

An interesting résumé is given of the previously reported cases of pneumococcus infection of the peritoneum.

In the same journal, Foulerton, in describing the pathology of pneumococcus infection, also refers to involvement of the peritoneal cavity and peritoneum.

Complications. PAROTITIS was mentioned last year as a complication of pneumonia. In a report of a new case Norris⁴ cites 17 cases reported up to the time of the appearance of his paper. Stern⁵

¹ New York Medical Journal, August 10, 1901.

² La Presse Médicale, January 26 and February 20, 1901.

³ British Medical Journal, September 21, 1901.

⁴ Philadelphia Medical Journal, April 27, 1901.

⁵ New York Medical Record, April 20, 1901.

states that this is a rare complication of pneumonia, only six instances having been seen among 5738 cases in the Vienna hospitals. In a case seen by him, the symptoms appeared on the day following crisis. The whole gland sloughed and in the suppurating tissues there were found diplococci supposed to be those of pneumonia.

ENDOCARDITIS AND ARTHRITIS. Lunnois and Paris¹ have reported the case of a man, aged forty-six years, with pneumonia and arthritis of the wrist joint. On the seventeenth day of his illness a loud diastolic aortic murmur, with Corrigan pulse and increase of fever, developed, with the presence of a systolic murmur over all the large vessels. Death with meningeal symptoms occurred ten days after the onset of this complication. Autopsy showed a localization of the pneumococcus in the lungs, pleura, joints, and meninges. The heart was hypertrophied, but showed slight dilatation. There was a large vegetation on the aortic leaflet, consisting of fibrin, in which were present pneumococci. The authors note that when pneumococci attack the heart the aortic valve is the one usually infected.

EMBOLISM. An instance of a rare complication of pneumonia is reported by Aldrich.² A boy, aged eleven years, was attacked with croupous pneumonia immediately following a blow upon the left shoulder. On the ninth day of the illness choreaic movements were noted for twenty-four hours, followed by loss of power in the left arm and leg, without involvement of the face. The head and eyes were turned to the opposite side to that palsied. There was no stiffness of the neck or rigidity, and there was no equality of the pupils, while the ophthalmoscope revealed no change in the eye-grounds. Death occurred apparently from heart failure on the day following the onset of his cerebral symptoms. There was found at autopsy embolism of one of the right lenticulo optic arteries, although there was no source for an embolus found in the heart.

ABSCESS OF THE BRAIN AS A COMPLICATION OF PNEUMONIA is sufficiently rare to make the article by Boinet³ of much value. Seven cases from the literature are there set forth, and there are added two personal observations of abscess of the brain occurring in the course of pneumonia. One of Boinet's cases showed an abscess of the left cerebral hemisphere opening into the ventricles; the other—a small, purulent focus in the left cerebral hemisphere—rapidly developing in the course of an infection by the pneumococcus. In his first case the pus from the cerebral abscess gave a somewhat large number of encapsulated diplococci, staining by Gram's method, as well as some chains of streptococci. In the second case the cerebro-spinal fluid, the meningeal

¹ Bull. et Mém. de la Soc. Méd. des Hôp. de Paris, 1901, No. 8.

² Medical News, July 27, 1901.

³ Revue de Méd., February 10, 1901, p. 113.

exudate, and the pus from the abscess in the brain gave diplococci encapsulated, staining by Gram's method, with groups of staphylococci and some streptococci.

Treatment. Neuhoff,¹ following out the suggestion of Clement A. Penrose, has reported the use of hypodermoclysis with saline solution in eleven cases, and draws the conclusions that it is a useful adjunct to other treatment in some cases, and that it acts as a powerful heart stimulant when all others fail; also in increasing the secretions, in moistening the tongue, throat, and skin, and in lessening the delirium. He uses 92 grains of pure table salt to a quart of clean water, which was boiled and allowed to cool to 100° F. He employs the tissue beneath the breast for his injection.

After considering the results obtained by the various authors, and especially in regard to 147 cases tabulated from the literature, Tyler² concludes that it is exceedingly doubtful whether antipneumococcic serum has any effect on the condition of the affected lung, but he believes that it prevents and antagonizes toxæmia, and that therefore its use is a great addition in our therapeutics.

Sequelæ. PURPURA HEMORRHAGICA following acute lobar pneumonia is reported by Underwood.³ The case was peculiar in several particulars. In the first place, there was delayed resolution, then slight lameness of one ankle was present during the attack, an erythematous rash was present for a few days early in the course of the disease, and persistent epistaxis was present, and hemorrhage from the bowel occurred during the course of the attack. Although ergot was used freely, the hemorrhage continued until the patient was almost exsanguinated. In spite of all complications the patient recovered. The coagulation time is given as being from three to four minutes, although the exact method of determining it is not stated.

ACUTE INFLAMMATION OF THE THYROID GLAND terminating in abscess has been reported by Schlender⁴ as a sequel of acute croupous pneumonia. The patient was aged fifty-two years, who twelve years before had noticed slight swelling of the neck. After a sudden chill pain in the chest and cough developed, which were found to be due to a typical croupous pneumonia. Five days later the thyroid became swollen, and dyspnoea developed. Incision of the thyroid gland gave exit to a large quantity of thick yellow pus containing portions of calcified material and shreds of tissue. His condition seems to have been good until the twentieth day of the disease, when he had another

¹ Medical Record, May 11, 1901.

² Journal of the American Medical Association, June 1, 1901.

³ American Medicine, October 19, 1901.

⁴ Deutsch. Zeitschrift f. Chir., April, 1901.

chill, with rise of temperature, became drowsy, and gradually lost strength until death ensued from heart failure. At the autopsy there was found an abscess of the thyroid gland and malignant and varicose endocarditis of the aortic leaflet.

DIPHTHERIA.

Statistical. An extremely interesting study of diphtheria based upon 2093 cases of that disease has been contributed by Burroughs.¹ After analyzing the cases according to their age, with the mortality for each year of life, which differs in no essential particular from those already found in the literature, he gives the distribution of the diphtheritic membrane as follows: Both tonsils were the seat of membrane in 1528 cases; one tonsil in 243; the uvula in 404 cases; the posterior pharyngeal wall in 173 cases; the palate in 244 cases; the lips in 12 cases; the tongue in 3 cases; the epiglottis in 4 cases; the inner surface of the cheek in 1 case (interesting in connection with the occurrence of diphtherial bacilli in certain cases of noma, recently reported by Walsh); the external auditory canal, the outer canthus of the eye, and the labia in 1 case, while the nostrils were affected in 71 cases. An interesting case is detailed at some length, where the obstruction to breathing, supposedly laryngeal, was found on admission to the hospital to be due to the whole pharynx being filled with membrane. In the recital of the case it is incidentally mentioned that the patient was given diphtheria antitoxin in doses of 8000 units, the total administered during the course of the disease being 110,000 units. In connection with the discussion of the subject of the location of the membrane the author makes a statement which must strike everyone as being distinctly true. This is that the diphtheritic membrane represents the amount of local reaction taking place, but that it is not a safe index of the amount of toxin absorption. We frequently see cases apparently but little ill, with a large amount of membrane, while the next case seen may be one with but slight membranous formation, but with marked symptoms of toxæmia. In 1621 cases the throat is stated to have become clear on an average of 3.9 days after the administration of antitoxin. In the study of the nasal cases the statement is made that in about 40 per cent. of the whole number of cases of diphtheria there was more or less severe involvement of the nares. The interesting statement is made that in some of the worst cases with a very thick false membrane the cultures from the throat were persistently negative until the membrane began to disappear, when the bacillus of diphtheria was

¹ American Journal of the Medical Sciences, February, 1901.

found in cultures taken from the mucous membrane. As the author points out, this might readily happen, because bacilli in the false membrane may be dead when the culture is taken, and will therefore not grow on the medium employed. The opinion of one with such a vast experience is of value in regard to the time for the administration of antitoxin. To quote his own words: "Diphtheria is a terrible disease, and an early diagnosis is often a most important thing to the sufferer. Cultures should be taken in every case, but the physician should not await the report of the bacteriologist before giving antitoxin if he *thinks* he is dealing with diphtheria." Cardiac murmurs were found in 50.1 per cent. of the cases admitted, irregularity without murmur being present in 8.2 per cent., and irregularity with murmur in 33.5 per cent. *Bruit de galop* was present in 22 of his cases; 8 died, 14 recovered. The urine of 1757 cases which were examined showed the absence of albumin in 1256—a higher percentage than that usually given. Laryngeal stenosis was present in 337 cases. In 213 of these cases intubation was performed. Of those intubated 96 died from various causes, chiefly the toxæmia of diphtheria. As a curious contrast with former tables compiled before the introduction of intubation, tracheotomy was performed in only 3 cases. Other points in the paper are of extreme interest, but a sufficient abstract has been given to indicate of how much value a careful perusal of the paper would be.

"Bacteriological" Diphtheria. A contribution to the frequency of the presence of diphtheria bacilli in the throat without diphtheritic infection is made in a paper by Hewlett and Murray.¹ All of those having to do with any institution for the treatment of sick children recognize the fact that there constantly occur epidemics of the disease where the primary source of contagion cannot be ascertained. It is also, of course, well known that healthy throats frequently contain diphtheria bacilli. The systematic examination of throats of apparently healthy children is rather difficult to carry out without preventive measures. The authors mentioned made a bacteriological examination of the throats of 385 children, under the age of fourteen years, admitted for operation or for some reason other than diphtheria. In 92 of these cases the pseudodiphtheritic bacillus was discovered; in 58, or 15 per cent., the Klebs-Loeffler bacillus was found, showing that one out of every seven sick children is a possible source of a diphtheria outbreak. Of the cases examined 275 had reached the age of two years; the Klebs-Loeffler bacillus was found in less than 15 per cent. of these cases, the pseudodiphtheritic bacillus in nearly 28 per cent. In those under two years, on the other hand, the Klebs-Loeffler bacillus was present in 21

¹ British Medical Journal, June 15, 1901.

per cent. ; in other words, in the cases of children under the second year one out of every five is a possible source of an outbreak of diphtheria.

Complications. ACUTE CARDIAC DILATATION as a complication and the cause of sudden death in diphtheria is the subject of a portion of a paper by D. B. Lees.¹ The indication of such a condition of affairs existing is given by Lees as being feebleness of the pulse wave, feebleness and diffusion of the cardiac impulse, extension of the cardiac dulness to the left, feebleness of the first sound at the apex, with accentuation of the pulmonary second sound. A fifth sign is marked accentuation of the aortic second sound, this being present in spite of the absence of high tension in the radial pulse. This accentuation of the second sound in the aortic area is supposed by Lees to be due to a contraction of the splanchnic arterioles through some central vasomotor irritation caused by the toxins bringing about a rise of pressure, which can easily be seen to be dangerous if the ventricle is at the same time weakened.

ULCER OF THE STOMACH due to infection by the diphtheria bacillus has been reported by William R. Stokes.² The patient showed evidence of severe diphtheritic infection of the throat. On about the sixth day of treatment there was pain and hyperæsthesia in the epigastric region. At autopsy there was found an ulcer near the pylorus, which was covered with dark yellow membrane, with underlying necrosis. In the necrotic material diphtheria bacilli were found.

Pathology. One of the most valuable contributions to our knowledge of diphtheria made during the past year is that by Councilman, Mallory, and Pearce, who have based their studies of the bacteriology and pathology of the disease upon 220 fatal cases. A résumé of the findings which they have reported may be of value. A mixed infection by diphtheria bacilli and tuberculosis was found in 35, or 16 per cent. of their cases. In 1 case faucial diphtheria was found with puerperal sepsis, the latter having resulted from septic endocarditis due to streptococci. One of their cases had double infection, with diphtheria and erysipelas ; another was an instance of diphtheria occurring in the course of cerebro-spinal meningitis. Two of their series were examples of an association to which attention has been frequently called by others, namely, the occurrence of diphtheritic infection with typhoid fever. This combined infection occurred in only 2 of the cases studied by them, these 2 not being included in the 220 that formed the basis of their paper. One hundred and sixty-one of their cases were examples of pure diphtherial infection. In all but 8 of these cases cultures were made at autopsy from the heart's blood, liver, spleen, and kidney. In the blood from

¹ British Medical Journal, January 5, 1901.

² Johns Hopkins Hospital Bulletin, July, 1901.

the heart diphtheria bacilli were found 7 times; 3 times alone, twice with streptococci, and twice with staphylococcus pyogenes aureus, while the streptococcus was found alone 22 times, with the pneumococcus once; the staphylococcus pyogenes aureus was found alone 3 times, the pneumococcus alone once. Curiously enough, in the liver the diphtheria bacilli were found 30 times; uncontaminated 16 times, associated with a streptococcus 14 times, while the streptococcus was found alone in 24 cases. In the spleen the diphtheria bacillus was present in pure culture 16 times, associated with a streptococcus 3 times, while the streptococcus was found alone in 32 instances. In the kidney diphtheria bacilli alone were found 17 times and associated with a streptococcus 8 times. These results are of much interest because of the previously supposed infrequency of general dissemination of the diphtheria bacillus through the body. In the 59 cases where the diphtheria was complicated by scarlet fever or measles, or by both of these infections, cultures were taken from corresponding organs in all but 3 cases. In only 1 case was the diphtheria bacillus found alone in the heart's blood, the streptococcus being found alone 11 times. In the liver the diphtheria bacillus was found alone 5 times, with the streptococcus 7 times, while the streptococcus was found alone in 15 and associated with staphylococcus pyogenes aureus in 3. In the spleen the diphtheria bacillus was found alone 5 times, the streptococcus alone 17 times. In the kidney the diphtheria bacillus was found alone on 7 occasions, and combined with the streptococcus on 5 examinations, while the streptococcus was present alone in 13. They believe that from the number of fatal cases with general infection of the body by the diphtheria bacillus it would seem probable that the latter produces its toxic products in whatever situation it may be found. In the 4 cases of pericarditis occurring among their cases the streptococcus was found in all, in 1 case being associated with the pneumococcus. Seven cases of acute ulcerative endocarditis were found in their series, 2 cases occurring among cases of uncomplicated diphtheria, while 5 occurred among those associated with scarlet fever or measles. Bronchopneumonia occurred in 131 of their 220 cases. Curiously enough, 98 of these occurred in cases of pure diphtheria, while 33 occurred in those complicated by scarlet fever or measles. Empyema was present in 5 of their cases of diphtheria alone and in 2 of their group of cases of diphtheria combined with the other two infections. An interesting point which they bring out is the involvement of the antra and accessory sinuses of the upper respiratory tract. Fifty-two cases were examined as to the condition of these cavities, and in 33 inflammatory changes were found to be present. In all but 8 cases of involvement of these cavities the bacillus of diphtheria was found. They point out the significance of

their findings in relation to the likelihood of diphtherial infection being a potent factor in causing inflammatory conditions of a chronic nature after the specific infection has disappeared. The middle ears were examined in 144 of their cases, and in 86 were found to be diseased. As would be expected, a mixed infection of the middle-ear cavity with the bacillus of Loeffler and streptococci is extremely frequent. Abscesses in various locations were found to contain diphtheria bacilli with pyogenic cocci. In their group of cases membrane was found in the following unusual situations: On the tongue in 6; in the œsophagus in 5; in the stomach in 3; on the conjunctiva, skin, vulva, and vagina each in 1 case. Diphtheria bacilli were on section never found growing in the living tissue or in the areas of degenerative lesion in the epithelium; they were, however, found in the necrotic tissue, but usually only in the exudate. They believe that the first step in the infection is brought about by the toxic action of the bacilli in the mouth or throat, whereby necrosis is produced. This tissue having undergone necrotic change, then becomes a suitable culture medium. Among 60 cases fatty degeneration of the heart fibres was found in 36. This degenerative change varied greatly in its extent, but bore no relation to the duration of the disease. In 13 of the cases degeneration was so extensive that the muscle fibres were completely destroyed. Extension of the diphtheritic membrane into the bronchi was found in 43 cases.

These indicate the most striking points brought out by this study of diphtheria, but there are many interesting questions in the original article which render its perusal valuable.

VARICELLA.

Netter¹ has contributed an interesting article in regard to the various complications of varicella, many of which may give rise to a fatal issue. Some of these have been mentioned in previous numbers of *PROGRESSIVE MEDICINE*, and Netter's article is simply mentioned here to draw attention to the fact that the prognosis should not be too hastily declared favorable, especially where the general condition of the child is not perfectly satisfactory.

Suppuration in Varicella. An interesting article by Désandre² deals with the question of suppuration in varicella. After pointing out that suppuration is not a normal occurrence in the lesions of chicken-pox, he gives the results of his bacteriological and microscopical study of the pus of these suppurative lesions. He found a staphylococcus

¹ Archiv f. Kinderheilkunde, Band xxx.

² Gaz. Hebd. de Méd. et de Chir., February 24, 1901.

constantly present, and that the pus obtained from the lesions contained many polymorphonuclear leucocytes, whereas in the lesions of smallpox mononuclear leucocytes occurred in the greatest number. As he points out, undoubtedly suppuration in the chicken-pox lesion is due to secondary infection.

Varicella Maligna. Friedmann¹ has contributed an interesting article upon varicella maligna, dealing especially with the occurrence of nephritis as a complication, and of an ulcerative and even gangrenous condition of the eruption. He recites the case of a boy, aged one and a half years, who, according to the mother's account, had no vesicular eruption, but from the onset had ulcerative lesions. Although the child's condition was but little affected by the infection, and no doctor's services were called for, ten days later, fever, with swelling of the face and feet, occurred. When first seen his general condition was poor, his temperature elevated, pulse rapid and of high tension. On both buttocks and down to the popliteal space were closely arranged plaques of confluent, deep ulceration, with sharp edges and bright red base. Below the knees there were two or three ulcers on both sides. The intermediate skin was but little inflamed, and the abdominal portion of the body was free from superficial lesions. The neighboring glands were uninvolved. There was great œdema of the face and scalp and moderate œdema of the scrotum, while slight hydrothorax was found. The urine was found to contain a large quantity of albumin. Two days after he was first seen the albumin persisted, and he had some hæmaturia. Convalescence was completely established in two weeks. Chicken-pox was prevalent at the time, and the author believes that he had to do with a mixed infection or an extremely virulent infection of the specific agent.

SMALLPOX AND VACCINATION.

Etiology of Smallpox. During the past year or two a considerable amount of interest has been aroused anew in the study of smallpox, with special reference to the causative agent of this disease and of vaccinia. Naturally the study is one of intense interest, and although the questions involved are not yet fully decided, a review of some of the literature of the subject will, I believe, be not without interest. Rogers and Weil² have made a study of the so-called variola corpuscles. They found them easily visible in variolous pus stained with Loeffler's methylene blue, which stain the corpuscles take more strongly than do the other cell nuclei. They found that they varied in size from one to

¹ Deutsch. med. Wochenschrift, November 22, 1900, p. 759.

² La Presse Médicale, November 28, 1900.

three micromillimetres. The majority of them were free, but some of them were contained in large mononuclear leucocytes. These corpuscles they claimed were found even in the papular stage of the eruption, and that they were present in the blood as well as in the local lesions, and in varioloid as well as in variola. They also state that they have been found in the amniotic fluid of two pregnant women. The importance of this latter discovery is seen from the fact that many have claimed that these variola corpuscles were simply the result of nuclear fragmentation of the leucocytes. As there are no leucocytes in amniotic fluid, this explanation of their presence would, of course, not apply to the bodies found in this fluid. The authors injected variolous pus into the subcutaneous tissues of rabbits and also into the anterior chamber of the eye. The animals died in three weeks from septicæmia, some showing local formation of pus, but most of them being free from this. Where the material was injected into the anterior chamber of the eye a local reaction was observed which lasted for a week. Attempts were made to obtain a growth from variolous blood, and cultures were so obtained, but they were by no means so great as is seen in ordinary bacteriological growths. Sub-cultures could be continued up to eighteen generations without the loss of the characteristics of the organisms. After a week it was impossible to find these corpuscular elements in the culture, but successful inoculation could be made from it, while small, bright bodies suggesting spores were found in the medium. Their mobility and their envelope of protoplasm show that they are not simply nuclear débris, as has been claimed; while that they are not of vegetable origin is shown by the fact that they do not resist the action of dilute alkalis. It is supposed that these organisms are protozoa, and that they have a distinct etiological power in connection with variola.

Experimental Vaccinia. Calmette and Guérin¹ have made a study upon experimental vaccinia. In all cases where vaccination of guinea-pigs was practised small pustules followed. These were filled with a large amount of lymph if the vaccine virus were spread on the shaven skin instead of being rubbed in with scarification. The lymph obtained from these pustules was found to be quite virulent. Guinea-pigs were found to be susceptible only to a virulent virus, and the authors suggest the vaccination of this animal as a good test for the efficacy of a given vaccine lymph. They found that inoculation from the organs of the animal so vaccinated gave rise to no evidence of cowpox, and conclude that the virus confines its influence to the skin itself. They also found that the active agent of vaccinia could not produce its effect by a gen-

¹ *Annales de l'Institut Pasteur*, 1901, No. 3.

eral infection of the body, but only by general toxæmia from a local infectious lesion in the skin, as it was discovered that if vaccine material were injected into the peritoneal cavity the peritoneal lymph obtained in a few hours was found to be perfectly sterile, or, in other words, that the virulence of the virus was weakened by its environment.

In another paper in the same journal these authors found that vaccinal immunity could be produced in the rabbit in five or six days. From their experiments they conclude that the infective agent does not multiply in any organ save the skin to which leucocytes have free access, and that a lesion of the skin is necessary for the implantation of the virus and for the evolution of its various stages. They were unable to cultivate the living agent of vaccinia, although they found on culture media minute, refractive, motile granulations which they believe may be the cause of the disease, as similar bodies are never met with in the blood or in other exudates in animals with the eruption of vaccinia. These bodies were found to be larger in glycerinized vaccine, and they state that after a sufficient experience it is possible to tell by the microscopical examination alone whether the virus will be efficient or not, according to the number of these bodies present. The conclusions that are reached in their papers are: 1. That inoculation of vaccinia in the rabbit is always followed by the eruption of small, confluent pustules, which are very rich in lymph, and these pustules follow, even though the freshly shaven skin be not grossly scarified. 2. That the rabbit is an excellent control-animal in regard to the strength of vaccine virus. 3. That multiplication of the virulent elements of vaccinia appears to take place only in the skin of the rabbit. 4. That aseptic vaccine material may be obtained by having the virus remain for several hours in the peritoneum of rabbits, wherein the leucocytes remove the foreign micro-organisms first, and after the lapse of a longer time destroy the specific agent of vaccination.

Specific Cause of Vaccinia. Funck, in a series of articles which have been abstracted and translated in various journals throughout the past year, but which have appeared in their original form in numbers of the *Deutsche medicinische Wochenschrift*, has strongly urged the claim that the protozoan organisms described by Gaurneri and Pfeiffer are the true cause of vaccinia. These bodies are described by him as small organisms ranging from one to three microns in diameter, together with larger cyst-like bodies measuring even twenty-five microns in diameter, which can be seen to contain spores. These spore-containing bodies were found to increase in number when sterile lymph containing only a small number of the protozoa was spread on agar and kept in the thermostat for twenty-four hours. When isolated after cultivation these large bodies produce lesions which Funck claims to be typical vaccinia,

and animals so inoculated were found to be immune to later inoculation from the pustules of vaccinia. The protozoa which he has again described are found in the vaccinia pustules and in the tissues immediately surrounding them. Similar protozoa were found by Funck in the lesions of variola. Funck's conclusions are : (1) That vaccinia is not a bacterial disease ; (2) that it is due to an infection with protozoa, the latter being readily found in all the pustules of vaccinia and in active vaccine lymph ; (3) that inoculation of these parasites produces immunity from further infection by vaccinia ; (4) that inoculation with these parasites causes all the classical appearances of vaccinia ; (5) that the protozoa of variola are morphologically similar to those of vaccinia ; (6) that vaccinia and variola are identical affections, the former of which is simply a milder manifestation of the more severe infection. Objection to Funck's views have been made, among others, by Podwyssozky and Mankowski, that the organisms described by Pfeiffer and cultivated by Funck are not true protozoa, but are pathological lesions of the tissue cells. Funck grants their contention that degenerated glandular and epithelial cells are present in vaccine fluid, but insists upon the fact that the bodies described, while resembling in some ways these cells, are entirely different, and points out two or three peculiar staining characteristics. Silvestrine has also raised practically the same objection to Funck's views. To his article Funck¹ answers that the organism is found in three stages : (1) In the condition of free spores ; (2) as cell inclusions ; and (3) in an encysted condition ; while in the case of the organism found in variola division of the spores may be seen on the warm stage of the microscope.

Even should Funck's views require further modification, the renewed attention to this subject excited by his observations and publications will surely shortly be followed by further studies by which we may reasonably expect to obtain positive knowledge in regard to this very important question. In the past year two sets of observations have been made having an important bearing upon this subject (the papers of Roger and Weil and those of Funck). The bodies described by these authors differ in some important particulars, chief of which is the fact that Roger and Weil found that organisms described by them stained well with aniline dyes, while Funck found his organisms staining but poorly or not at all with these materials. Further observations, therefore, are essential to the proper solution of this important question.

S. Monckton Copeman² records a series of experiments in which he employed collodion capsules filled with beef-broth inoculated with a

¹ Journ. Méd. de Brux., 1901, No. 25.

² British Medical Journal, February 23, 1901, p. 450.

trace of glycerinated vaccine lymph free from extraneous microbes. The collodion capsules were then sealed and placed within the peritoneal cavity of rats and dogs. If the capsule remained entire it was found that no leucocytes were present in its interior, but serum-albumin and lymph had been able to dialyze through the walls of the capsule. Film preparations made from capsules remaining entire in the peritoneal cavity for a week or two showed, after staining with methylene blue, numerous zoöglæa masses composed of bodies resembling spores. The periphery alone of these bodies took the stain. He believes that they represent the resting stage of the specific microbe. He found that the fluid contents of these capsules was capable of producing a typical eruption of vaccinia in the calf, "although the contents of control capsules placed in test-tubes partially filled with beef-broth and incubated at the body temperature for periods varying from a week to a fortnight gave no results." He states also that he has demonstrated the presence of what appeared to be similar micro-organisms in extraordinary numbers in the epithelium of vesicles of the calf and in human smallpox.

Another interesting communication is made by Copeman.¹ It concerns the relationship of vaccinia to the inoculated form of smallpox in man. He was induced to make the observation from the fact that he and others had found difficulty in transmitting human smallpox to bovines. In view of the fact that probably much of the cowpox observable in Jenner's time was derived from human cases of inoculated smallpox, instead of those contracting the disease in the ordinary way, he determined to test the question by experiments upon monkeys. The human material from a case of smallpox was first directly inoculated on calves. These experiments were without result. With monkeys, on the other hand, success was invariably obtained. After one or more passages through the monkey typical vaccinia was produced in the calf by inoculation with the poisons derived from the former animal. From the contents of the vesicles so produced in the calf typical vaccination was obtained in children.

VACCINAL SKIN LESIONS. Norman Walker² mentions four cases of recently vaccinated individuals showing skin lesions. These all were erythemas of various kinds. The author does not state definitely whether he employed the glycerinated or dried lymph.

¹ British Medical Journal, May 11, 1901, p. 1134.

² Ibid., May 18, 1901, p. 1201.

MEASLES.

Complications. NOMA. In an interesting article upon the epidemic occurrence of noma, Blumer and McFarlane¹ spoke of an epidemic of measles affecting 173 children in the Albany Orphan Asylum. Among these children noma occurred in 16 cases, of which the mouth alone was affected by the disease in 4, the mouth and other parts in 3 cases, and the vulva alone in 2, and combined with noma of other portions of the body in 7 cases. The rectum was involved alone in 3, while in 5 the rectum was involved at the same time with gangrene in other parts. Only 2 of the 11 cases of noma without other complication aside from the original disease died; 5 of the children had pneumonia and noma together. Of these all died. Of the fatal cases noma involved the mouth in 3 children, the rectum in 4 children, although in 5 of these the direct cause of death was pneumonia.

DIPHTHERIA AND MEASLES. The association of measles with diphtheria as a complication has been frequently noted. Blakely and Burroughs² saw in two and a half years 157 patients who had measles combined with diphtheria. Fifty-four (34 per cent.) of their patients died, while the death-rate for uncomplicated diphtheria during the same period was only 13 per cent. Eighty-two cases had laryngeal involvement, 47 requiring intubation, and death occurring in 55 per cent. In the 35 laryngeal cases which were not intubated the death-rate was 29 per cent. All of their fatal cases had involvement of the larynx. Five of the 54 cases were moribund on entering the hospitals, while 6 others were nearly so. The cause of death is given as follows: Toxæmia of diphtheria, 21; late nerve degeneration due to diphtheria, 10; bronchopneumonia, 15; bronchopneumonia with chronic tuberculosis of the lungs and bone, with acute pericarditis, 1; gangrenous stomatitis, 2; uræmia, 2; streptococcal infection, 1; and a triple infection of scarlet fever, measles, and diphtheria, 2.

EMPHYSEMA. In a child aged four years, with measles, Evens³ saw generalized emphysema. The child had moderate bronchitis, with discharge from the left ear, but with the exception of the latter symptom the course was not unusual. The cough was never severe or paroxysmal. Six days after the onset swelling in the left supraclavicular region was noted. The voice was then lost, the face became swollen, and finally the head, back, abdomen, left arm, and the left thigh to the knee became emphysematous. The emphysema gradually disappeared as the general condition improved, and a perfect recovery followed.

¹ American Journal of the Medical Sciences, November, 1901, p. 528.

² Boston Medical and Surgical Journal, July 25, 1901.

³ Montreal Medical Journal, January, 1901, p. 8.

DYSENTERY.

Pathology. A valuable study of dysentery as it occurs in the Philippine Islands has been made by R. P. Strong,¹ of the United States Army. In sixteen months 1830 cases were admitted to the First Reserve Hospital. Of these only one-third were able to return to military duty. One hundred and eleven cases came to autopsy; 79 of these were examples of amœbic dysentery, and among these the amœba was found at necropsy in 68. Twenty-one cases are classed as acute specific dysentery, 11 as instances of a subacute form of that disease. He divides dysentery into infectious (acute, subacute, and chronic) and amœbic dysentery. The first is recognized by its specific blood-serum reaction, the other by the presence of the amœbæ in the stools. An interesting study was made by him as to the morphology, cultural characteristics, staining properties, and pathogenicity for animals of the bacillus described by Shiga. The infectious form of dysentery was found to occur more frequently toward the end of the rainy season, more cases coming to autopsy in July, August, and September of 1899 than in all the rest of the year put together. In 28 of their cases of infectious dysentery the bacillus of Shiga was found, while at autopsy it was isolated in 17 out of 21 acute cases. In 2 subacute cases out of 12 autopsies it was present, while in 7 it was not found, and in 2 it was not looked for. The bacillus was never found in the stools of cases other than those of dysentery. He found that the blood-serum in the acute and subacute cases usually showed an agglutinative reaction, sometimes as early as the third day, usually marked by the fifth or sixth day, and occasionally persisting for several months. An interesting résumé of the clinical history of these cases is given in the report quoted, but it can hardly be abstracted in this place with advantage. His description of the pathological appearances should be read by all those interested in the subject. True ulceration of the bowel wall would seem to be unusual in the acute cases, the lesion of the intestine being more of a coagulation necrosis of the surface. It is interesting to note that in no case was abscess of the liver found. The bacillus was found only in the superficial layers of the mucosa, although in 2 cases it was obtained from hemorrhagic glands in the mesocolon. In 246 cases of diarrhœa and dysentery of various types 71 showed a positive agglutinating reaction in dilutions of 1 to 10 in 20 minutes. In these 71 cases of positive agglutinating reaction all gave either a history of recent dysentery or were suffering at the time with an acute attack, while in

¹ Circular of Tropical Diseases, No. 2, Chief Surgeon's Office, Division of the Philippines, April, 1901.

21 of these cases the bacillus of dysentery was found in the stools. Only 3 of the cases with a positive serum reaction showed amœbæ in the stools. In 3 cases there was found a double infection with the *B. dysenteriae* and the amœba. The bacillus of dysentery was never found in the intestine or stools of cases of true amœbic dysentery, these being found together only in the cases where there was evidently a double infection. The pathological picture of amœbic dysentery shows deep dissecting ulcers similar to those frequently described as characteristic of that condition. The intestinal fauna of 26 of their amœbic cases was carefully studied. Except for the colon bacillus they only found the bacillus lactis aërogenes, streptococci, and staphylococci. Strong is convinced that there are two varieties of amœba in the stools of those living in Manila. One of these occurs in amœbic dysentery; another occurs in cases with no dysentery, either past or present, and is smaller than that found in amœbic dysentery, and has never contained red blood cells in its interior. A case is cited where the latter variety of amœba were constantly present in the stools of the patient under observation for several months, without history of dysentery and without any present intestinal trouble. Injection of these amœbæ into the rectum of cats produced no effects, while with a smaller injection of the amœba from dysenteric cases, amœbic dysentery and intestinal ulceration were readily produced.

The conclusions which Strong draws are that there are two distinct forms of dysentery in and about Manila, one of which is an acute, specific infectious dysentery, the other an amœbic dysentery. He also concludes that the first form is probably caused by the bacillus of dysentery, and is incapable of experimental production in animals, while the second form is caused by the amœba of dysentery, and can be produced experimentally in cats. The two types can be easily separated clinically by a blood-serum reaction on the one hand, and the presence of amœba in the stools on the other. "There are also at least two forms of amœba found in the human stools. The first form, amœba dysenteriae, is capable of producing dysentery and dysenteric lesions in man and cats. The other, amœba coli, is apparently not harmful to either of these."

Deycke¹ has studied the etiology of dysentery in Constantinople. There was constantly found by him a bacillus which grew in pure culture, seemed to belong to the colon group, and to resemble the bacillus of Eberth. This bacillus was always found in the stools, in the intestinal walls, and in the abdominal organs of dysenteric patients. The bacillus was pathogenic to cats, the animals dying, as a rule, after

¹ Deutsch. med. Wochenschrift, January 3, 1901.

one to three days of bloody or purulent diarrhoea, and showing after death the typical lesions of diphtheria.

Serum-therapy. The bacteriological investigation of dysentery, while a very recent growth, already seems to give promise of practical results in the form of serum-therapy. Shiga,¹ to whom we owe so much in regard to the nature of dysentery, has been working on the production of an antitoxin for use in combating the disease. In obtaining the serum containing antitoxin he prefers the use of the horse or ass. Bacilli obtained from a slant agar-culture are incubated for twenty-four hours and then ground up in an agate mortar and mixed with physiological salt solution. This mixture is then heated for twenty minutes at a temperature of from 50° to 60° C. A small dose of this mixture was first injected under the skin of the animal. This caused a rise of temperature and malaise, which disappeared in two or three days. After an interval of not longer than two or three weeks the injection was repeated with a larger dose. Thereafter the material was injected intravenously. After three weeks of this treatment serum was obtained from the animal, and carbolic acid added in the proportion of 5 per cent. A dose of from 6 to 10 c.cm. is advocated for mild cases, while in the severer forms this should be increased to from 15 to 20 c.cm., the dose being repeated on the succeeding day if the symptoms are not relieved. He claims that there is a marked curative influence exerted by the antitoxin so used. Of the forty patients to whom the antitoxin was administered fifteen had an eruption around the seat of inoculation, one had an eruption over the whole body, and two had articular pains.

TUBERCULOSIS.

During the past year one of the most striking features of medical progress has been the increasing interest taken in preventive measures against tuberculosis. The growth of registration and notification, the prevention of dissemination through expectoration, and the segregation of patients afflicted with the disease have been constantly receiving more and more attention. Together with this, the education of the public in regard to the contagious character of the disease has been making large strides. Nothing particularly new has been discovered regarding the etiology or treatment of the tuberculous infection, save for one communication which must be taken into account in reviewing the progress of the year. At the meeting of the British Congress on Tuberculosis, held in London during July, an important paper was read by Koch. The eminence of the author, the importance of the subject,

¹ Sei-I-Kwai Medical Journal, June 30, 1901.

and the discussion which it has called forth make it advisable to give his views extensive notice in such a résumé of the year's work as this series of articles is meant to be. The title of Koch's address¹ is "The Fight Against Tuberculosis in the Light of the Experience that has been Gained in the Successful Combat of Other Infectious Diseases." After pointing out the ravages produced by tuberculosis, Koch expresses the hopeful view that eradication is possible. He points out that in plague we now know that the plague patient transmits the disease directly only where plague pneumonia is present, and that the real transmitters are rats. He also reminds us that in cholera entirely different conditions prevail, the disease being rarely transmitted from man to man, but being chiefly carried through water; that while in the case of one infectious disease (plague) infection by the rat is to be combatted, in another (cholera) care of the water-supply is the important point. Again, in hydrophobia we know that the disease is transmitted through the bites of animals, and that the prevention of the disease depends upon the enforcement of muzzling orders. Leprosy, again, has a different mode of transmission in that it occurs immediately from the sick to the healthy, and the method of prevention is the separation of the sick from the well by isolation. His remarks upon these contagious diseases were meant to show how widely different are the methods of transmission of different diseases, and how necessary a knowledge of the mode of transmission is in preventing the spread of transmissible diseases. Coming to tuberculosis, he points out that in the vast majority of cases tuberculosis infects the lung (a point which no one will dispute), and that the main source of contagion is the sputum of an infected individual. The portion of his address which has given rise to discussion and which demands notice in this place is that wherein he considers the relations between human and bovine tuberculosis. After pointing out bovine as the only form of that infection as it occurs in the lower animals that requires consideration, he states that only after attempting experimental investigations upon cattle was he able to arrive at positive conclusions in regard to the danger to the human being of infected foods derived from the lower animals. A number of young cattle previously tested with tuberculin, and found by it free from tuberculosis, were infected with pure cultures of tubercle bacilli from human sources. Six animals were fed with tuberculous sputum almost daily for seven or eight months. Four were subjected to repeated inhalations of large quantities in spray. Nineteen animals in all were examined in this way, and also by intraperitoneal, hypodermic, and intravenous injections of tubercle bacilli. None of these showed symptoms of the disease, and

¹ British Medical Journal, July 27, 1901, p. 189.

they gained considerably in weight. The animals were killed after six or eight months, and in none of the internal organs was there a trace of tuberculosis. "Only at the place where the injections had been made small suppurative foci had formed, in which a few tubercle bacilli could be found," showing, according to his views, that the animals experimented upon were affected by the living bacilli of human tuberculosis as they would have been affected by dead ones. When tubercle bacilli of bovine source were used he obtained exactly opposite results. "After an incubation period of about a week the severest tuberculous disorders of the internal organs broke out in all the infected animals," no matter by what channel the bacilli gained entrance to the system. After death extensive tuberculous lesions were found where the injections had been made, in the lymphatic glands and in the internal organs, especially the lungs and spleen. Six young swine were fed daily for three months with tuberculous sputum of human source, while an equal number received bacilli from bovine tuberculosis. Those fed with the bacilli of human origin "remained healthy and grew lustily," while those fed with bovine tuberculous material became sickly, were stunted in their growth, and half of them died. The other three fed with bovine tuberculosis were killed after three months and a half, and showed extensive tuberculous infection; while the animals fed with human tuberculosis and killed after the same interval showed no sign of infection except for little nodules in the lymphatic glands of the neck, and, in one case, a few gray nodules in the lung. Asses, sheep, and goats were also experimented upon by injection into the vascular system of tubercle bacilli from human and bovine tuberculosis with practically the same result. His experiments would go to show, therefore, that cattle are not susceptible to infection by tubercle bacilli obtained from human sources. His argument in regard to the converse of this proposition is about as follows: Milk and butter containing bacilli of bovine tuberculosis are taken in large quantities, especially in the large cities. If the bacilli of bovine tuberculosis were capable of infecting the human, large numbers of cases of human tuberculosis of the alimentary canal would occur. He then points out the extreme infrequency of primary intestinal tuberculosis, and states that it is by no means certain that in the few cases observed the infection was due to bovine tuberculosis and not to tubercle bacilli of human origin. He believes that in order to determine to what source the intestinal infection should be traced, it is only necessary to make a pure culture of the bacilli from the tuberculous material, and to then test its pathogenicity for larger animals. The concluding paragraph of this portion of his address is as follows: "Though the important question whether man is susceptible to bovine tuberculosis at all is not yet absolutely decided,

and will not admit of absolute decision to-day or to-morrow, one is nevertheless already at liberty to say that, if such a susceptibility really exists, the infection of human beings is of very rare occurrence. I should estimate the extent of the infection by the milk and flesh of tuberculous cattle, and the butter made of their milk, as hardly greater than that of hereditary transmission, and I therefore do not deem it advisable to take any measures against it."

The portion of his address which has been above abstracted has given rise to much controversy, and has been recognized as possessing vast importance not only from the hygienic, but from the economic standpoint.

The eminence of the author of this paper and the importance of the subject have given rise to much discussion, and doubtless at the present time much work is being done in various countries to either confirm or contradict the results obtained by Koch.

The impossibility of experimental determination as to the susceptibility of the human being to tubercle bacilli of bovine source requires that we should fall back upon accidental inoculation as the only way of confirming the idea always held, that primary intestinal tuberculosis could be produced by the ingestion of tuberculous material with the food. While many cases are seen—particularly in any hospital devoted to the treatment of children—where the focus of infection would seem to have been the intestine, it is frequently impossible to be sure that this was the primary port of entrance of the poison because, as a rule, these cases when they come to autopsy show wide-spread tuberculous infection, and it is wellnigh impossible to prove that a small tuberculous deposit in the lung or in the bronchial lymph nodes may not have been the source from which the intestines and mesenteric glands received their infectious material. The occasional occurrence of cases of apparently true primary intestinal tuberculosis, and the greater frequency of such cases among those of an age most likely to be infected by their food (in the form of milk) does not allow of sweeping generalizations.

In a paper by Ravenel,¹ which was read at the same Congress before which Koch read his paper, many facts are brought forward having a distinct bearing upon this question. He quotes the examples of accidental infection which have occurred in man, and refers to cases which he himself has seen wherein the infecting organism was positively known to be of bovine origin. Ravenel's results with the lesions produced in animals by the inoculation of human and bovine tubercle bacilli contradict to some extent the results obtained by Koch; for instance, in Table VI. of his paper he gives the results of inoculation of

¹ University of Pennsylvania Medical Bulletin, September, 1901.

human and bovine material in horses, pigs, sheep, dogs, and cats as follows: Bovine material used directly on horses produced extensive disease of the thoracic cavity. Bovine material passed through guinea-pigs produced extensive involvement of the lungs. Human material used directly produced in one horse limited involvement of one lung. In pigs bovine material used directly produced extensive disease of the thoracic cavity, and the same result followed the use of bovine material passed through guinea-pigs as well as from human material used directly. In the pig human material which had been passed through other animals was found to be rapidly fatal, but the process was confined mainly to the lungs. Bovine material used directly or after passing through guinea-pigs produced in sheep extensive disease of the thoracic cavity, while in this animal the human material used directly caused a limited involvement of one lung and the pleura of the same side in one animal. Practically the same result was obtained in the case of dogs. In cats the bovine material inoculated directly produced extensive disease of the thoracic cavity and spleen, that previously passed through guinea-pigs produced extensive disease of the thoracic cavity and mesenteric glands, while in these animals the human material employed directly caused no tuberculous lesion. An attempt to infect calves by feeding them with human sputum gave no evidence of success. Ravenel brings forward the statistical evidence regarding tuberculous infection of the intestine in children, evidence which, as Ravenel states, "is purely circumstantial, yet of such strength as to be most convincing." Ravenel's conclusions are as follows:

"1. That the tubercle bacillus from bovine sources has in culture fairly constant and persistent peculiarities of growth and morphology, by which it may be tentatively differentiated from that ordinarily found in man.

"2. That cultures from the two sources differ markedly in pathogenic power, affording further means of differentiation, the bovine bacillus being very much more active than the human for all species of experimental animals tested, with the possible exception of swine, which are highly susceptible to both.

"3. That tuberculous material from cattle and from man corresponds closely in comparative pathogenic power to pure cultures of the tubercle bacillus from the two sources, for all animals tested.

"4. That it is a fair assumption from the evidence at hand, and in the absence of evidence to the contrary, that the bovine tubercle bacillus has a high degree of pathogenic power for man also, which is especially manifest in the early years of life."

It is important that this question should be definitely determined at the earliest possible moment. Such huge commercial interests are at

stake that, if Koch's view is correct, an early amendment of the laws governing the sale of foods should be at once put into effect. If Koch's conclusions are faulty this fact should be established at the earliest possible moment, in order that the good work already done in the matter of preventing tuberculosis from food infection should not be lost. Before the publication of the summary of the work done on contagious diseases, a year from this time, it may be presumed that either Koch's views will be overthrown and even more stringent laws made in regard to the prevention of human tuberculosis of bovine origin, or else that steps will have been taken to rearrange the present statutes in regard to food supplies. Meantime, it would seem that in spite of the high authority from which this theory of non-identity of the bacilli had emanated, the existing precautions should be maintained to prevent the spread of tuberculosis through contaminated meat and milk.

Another article having a close bearing on the whole question raised by Koch's paper has been contributed by Bovaird.¹ The author critically and carefully reviews the previous work appearing in the literature upon the subject of intestinal tuberculosis in childhood, and gives valuable tables in regard to the frequency of this primary affection of the intestine in various countries. The author himself, out of 1110 autopsies, found tuberculosis in 125 cases. Among these 125, two cases were apparently instances of primary intestinal infection. He draws attention to the relative rarity of this condition among children in New York as compared with those in other countries, especially in Great Britain, and concludes that the evidence connecting tuberculosis among children with the consumption of the milk of tuberculous cows is very scant. In the same number of this journal he details the history and post-mortem findings in one of his cases.

YELLOW FEVER.

Transmission by Mosquitoes. The importance of determining the exact etiological factor of yellow fever is no more important than is the discovery of its means of entrance into the human system. The determination of the mode of transmission of the disease is of particular importance to the United States, as the disease has been prevalent not only among our island neighbors, but in a large tract of territory in the southern portion of our own country. It is, however, important for commercial reasons to other countries as well as our own that the true carriers of the infection should be definitely determined. Many years ago Finlay advanced the theory that the mosquito was the active agent

¹ Archives of Pediatrics, December, 1901.

of transmission of the disease. But little attention was paid to his announcement until recently, when, stimulated by the facts discovered in regard to the rôle of the mosquito in the transmission and propagation of malarial fever, renewed and scientifically conducted experiments were performed in order to definitely prove the stability of Finlay's theory.

A most interesting and convincing report upon this subject has been issued during the past year under the joint authorship of Reed, Carroll, and Agramonte.¹ The bearing of this paper upon preventive medicine, and, from the more purely commercial stand-point, upon the necessity for continuing our present methods of maintaining quarantine, can be readily appreciated. Human experimentation was employed in those volunteering for the purpose. Out of sixteen individuals who consented to submit themselves for experimental inoculations fourteen contracted yellow fever, while five others who did not consent to the experiment and were not immune did not acquire yellow fever, although their surroundings were similar to those of the set inoculated. The first case was injected subcutaneously with 2 c.c. of blood from a case of mild yellow fever. A second case was given a subcutaneous injection of 1.5 c.c. of blood taken from this first case. Two days later there appeared all the premonitory symptoms of a very mild attack of the disease. The third patient was inoculated with 0.5 c.c. of blood from the general circulation of a severe case of yellow fever. Two days later he began to run through a fairly severe attack of yellow fever. A fourth case received 1 c.c. of blood from the median cephalic vein of the preceding case; two days later he also began an attack of yellow fever. These experiments showed that the parasite lived in the blood at least in the early stages, and that the infection of an intermediate host was not necessary. They then tried the effect of infection by way of the *Culex fasciatus*. The first case experimented on in this way was a young non-immune American. He was in quarantine thirty days, in order to make certain the source of his infection. He was bitten by three mosquitoes which, thirty-nine days previously, had been fed on blood from a case in the third day of well-marked yellow fever. Four days later he began a typical attack of yellow fever. The second case in this series was bitten by two of three mosquitoes that had been applied to the case just mentioned (fifty-one days after their contamination). The same two mosquitoes were again caused to bite another non-immune. Again, at the end of three days the symptoms of yellow fever were noted. The fourth case of the series, after being in quarantine for twenty-five days, was bitten by three mosquitoes which, sixteen days previously,

¹ Transactions of the Association of American Physicians, 1901.

had been contaminated by biting a fatal case of yellow fever on the second day of his disease. On the third day he also was seized with the early symptoms of yellow fever. The first three cases of this series show that the insect is capable of infecting a new individual even as long as fifty-seven days after contamination of the insects. One of the insects which they used lived for sixty-nine and another for seventy-one days after contamination, a point which is of very great importance. They detail one observation which goes to show that at certain periods of the disease the mosquito may bite the patient without its becoming contaminated, probably from the fact that at that particular time the parasite was absent from the capillary circulation. Two negative observations were made in regard to the possibility of other varieties of culex being capable of acting as bearers of the parasite, and as to the transmission of the parasite from the mosquito to its ova.

Incubation Period. The experiments of Reed, Carroll, and Agramonte show more definitely than would be possible from bedside observation alone the length of time during which the disease is incubating. The importance of this observation is, of course, of great practical interest from the stand-point of public health and quarantine. In their sixteen cases the shortest period of incubation was one day and nineteen hours (one of the cases injected with blood); the longest was six days and two hours (mosquito infection). The average period for their sixteen cases was eighty-seven and one-quarter hours. Accepting the mosquito-bite as an ordinary medium for contamination, their experiments would show that in one case the onset of the disease occurred on the third day after infection, in nine on the fourth day, in one on the sixth day, and in one at the beginning of the seventh day. In 16.6 per cent. the period of incubation exceeded five days.

Findlay¹ reports the results of his experiments in regard to inoculation of yellow fever carried out during the past seventeen years. His experiments were performed as follows: At a time when there were no cases of yellow fever in the neighborhood he caught young mosquitoes in his own dwelling. Each of these was placed in a small vial or test-tube and kept without food or water until it had been made to bite patients with severe symptoms of yellow fever. One hundred and two non-immune persons had been inoculated with mosquitoes so infected during the seventeen years from 1881 to 1898. In 17 cases some febrile reaction occurred; 2 had mild albuminuric attacks of yellow fever; 6 had non-albuminuric yellow fever; 3 had abortive attacks, while 6 had "ephemeral fever of doubtful diagnosis." Of these 17 cases 2 of the 6 in the last class showed no immunity, as was evidenced

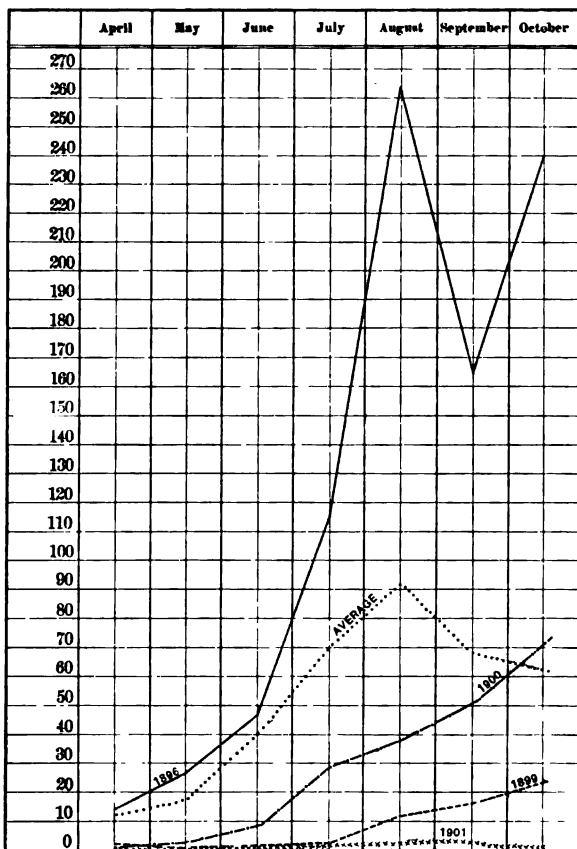
¹ Journal of the American Medical Association, November 23, 1901, p. 1387.

by their having severe yellow fever afterward. Of the 3 cases with abortive reactions 1 had "another attack of the same character two years later." The 6 non-albuminuric yellow fever cases gave 1 with a similar attack a few months later after a severe exposure to infection. Of the 2 who had the mild albuminuric attack of yellow fever neither subsequently developed the disease. Less than 4 per cent. of his patients so inoculated died of yellow fever, although among these 102, 19 had albuminuric yellow fever, usually mild, but 4 of them severe; 17 had non-albuminuric yellow fever, and 9 had abortive yellow fever. This left 53 of his 102 cases, and in none of these had yellow fever ever appeared. Finlay believes that his experimental results were slight as compared to those of the Yellow Fever Commission, represented by Reed, Carroll, and Agramonte, partly because of the fact that he starved his mosquitoes instead of feeding them on sweet fruit-juices or sugary solutions. Finlay therefore believes that there are two ways by which yellow fever can be conveyed by mosquitoes from the sick to the well. One consists in allowing the yellow fever mosquito to become infected so that the salivary and venom glands become the seat of "a local, chronic, life-long infection which is attended with a constant reproduction of yellow fever germs, so that the contaminated mosquito will therefore inoculate some of those germs with every bite." Another way to produce the disease would be the direct injection of the germ from the blood of the yellow fever patient directly under the skin of the non-immune, or, presumably, as may occur when mosquitoes at once bite a non-immune after drawing blood from a yellow fever patient. He argues, therefore, that there are two periods when the bite of the mosquito is dangerous. First, shortly after it has bitten a yellow fever patient when germ-laden blood is within the sucking apparatus; and, secondly, after the germ has had an opportunity, from the lapse of a certain number of days, to thoroughly infect the salivary and venom glands. The first period would probably be short, because of the fact that the germs would be very liable to be washed out of the sucking apparatus by the secretion of the salivary glands of the mosquito or to be drawn into the stomach when food or water was taken by the insect. Finlay believes that after this short period of what might be called the first infective stage the insect then becomes harmless for ten or fifteen days. At the end of this time the germs within the mosquito's body "will have had time to multiply and to invade its salivary apparatus." Finlay thinks from his own experience that the recently contaminated mosquito produces mild fever, with little tendency to albuminuria and a long period of incubation, and advances the view that the bite of recently contaminated mosquitoes will be "found to constitute the only method which may be safely used, upon a large scale, for the purpose

of conferring an immunity." If Finlay's results are confirmed an important step in safeguarding immunization against yellow fever will have been taken.

Prevention of Yellow Fever. As a striking illustration of what has been done in preventive medicine through proper sanitary regulations under intelligent control, a reproduction of the chart accompanying the Report of Vital Statistics made by the chief sanitary officer to the Military Governor of Cuba is appended. In the body of the report the following two paragraphs occur. Further remarks upon their significance are rendered useless by the appended chart :

FIG. 1.



"I dwell particularly on the yellow fever phase of our vital statistics on account of its vast practical importance to the United States. The great truth that yellow fever is transmitted by the 'Stegomyia' mosquito, maintained by Dr. Charles Finlay against much ridicule for so many years, and recently demonstrated by the Army Board, must soon change all our methods of quarantine in the United States.

"In Havana, this year, we have worked upon the hypothesis that the mosquito is the only way of transmitting the disease. We have not considered fomites in any way. Clothing has not been disinfected, nor any effort made, except to kill the mosquitoes which had bitten a sick person, and to prevent any more mosquitoes from biting after the case was discovered. Our results with this plan were so positive that we soon saw that we could not only rid Havana of yellow fever on these lines, but that we could destroy each focus as it was renewed from the outside."

The practical bearing of these questions upon quarantine regulations is spoken of on p. 145, in the consideration of Rosenau's work upon the relative values of formaldehyde and sulphur dioxide in disinfection.

MALARIA.

Influence of Color upon Mosquitoes. So closely allied is the life-history of anopheles to that of malaria that any biological facts in regard to these insects is of importance at the present time. On this account a brief paper by Nuttall¹ is of interest. His object was to determine the influence of color upon the anopheles maculipennis. His experiments showed that these insects are attracted by some colors, repelled by others. The experiments were carried out in a large gauze tent in which large stone basins were placed as breeding-spots for the insects. It was noticed in the first place that on entering the tent the insects frequently flew up and settled upon the cloth of dark gray clothes, but they never did so when the person entering the tent wore white flannels. A number of boxes lined with rough cloth of different colors were placed in rows upon the floor and in tiers, the arrangement of the boxes lined with different colors being varied from day to day. By counting the number of insects in each box for seventeen days some interesting conclusions were arrived at, the boxes being preferred in the following order: navy blue, dark red, reddish-brown, scarlet, black, slate-gray, dark olive-green, violet, leaf-green, blue, pearly gray, pale green, light blue, ochre, white, orange, and yellow, in the order named. The progressively lessening attractiveness of the various colors was not, however, regular. The box lined with navy blue seemed to be very popular, as in seventeen days 108 insects were found within it. Dark red attracted 90 of the insects, reddish-brown 81, and so on down the list to the box lined with blue. From that point onward so few insects were found in the boxes that it seemed that the colors following that in the list given above rather repelled

the insects. The practical bearing of this upon the choice of color for a uniform (khaki being apparently theoretically advisable not only because of inconspicuousness to the human enemy, but also because of being distasteful to the anopheles) and the color for houses in a malarial district is obvious. Nuttall suggests that it is possible that a form of trap lined with a suitable attractive color might be of value. This seems rather a refinement of biological study, yet so many of the supposed refinements practised in the study of the life-history of the mosquito have been found to have a practical bearing in preventive medicine that these interesting experiments of Nuttall may be of practical benefit.

Preventive Measures. The measures being taken in Lagos in the battle against malaria have been reported by Sir William MacGregor.¹ The prophylactic administration of quinine has been employed by the government officers regularly; but the author points out that this is not compulsory, and cannot be relied upon in stamping out the disease except under exceptional circumstances. From the figures given it would seem that this prophylactic use of quinine had been of decided advantage among the officers employing it, although, unfortunately, no definite figures are given as to the relative numbers of Europeans taking quinine and native officers not taking it. A concrete example is given of two officers living in the same tent, the latter being full of mosquitoes. One officer, being unable to take quinine even in prophylactic doses, contracted the disease, while the other officer, who had been taking prophylactic doses, escaped. The usual method was the taking of daily doses of from $2\frac{1}{2}$ to 5 grains of quinine. The difficulty of thoroughly carrying out this preventive measure is chiefly met with in the natives, and prevents its being of very great practical utility. The use of mosquito-netting as a preventive measure has the disadvantage of preventing the thorough ventilation needed in that climate. In order to prevent the growth of mosquitoes marshes have been filled in, kerosene has been poured upon those pools which could not be drained, and the water-tanks are being rendered mosquito-proof. In addition to this, undergrowth has been cleared away and the lower branches of trees have been lopped. So far it would appear that the work has not progressed sufficiently to have stamped out the disease, although it is interesting to see under what unfavorable circumstances the fight is being made. In an article in the same journal Ross notices the difference between the habits of the natives and of the Europeans in India and Africa as regards their contracting malaria. The curious fact is pointed out that in Calcutta malaria is rare among European

¹ British Medical Journal, September 9, 1901.

citizens, but is frequent among the natives, while in the less populous districts malaria is much more frequent among the Europeans. This Ross believes to be due to the fact that in Calcutta, where such things as punkahs and mosquito-nets are available, the use of these things protects from mosquitoes, whereas in the less densely inhabited regions they are unavailable. In the same journal, Young speaks of the measures taken to prevent the incidence of malaria in Hong Kong, where anopheles is very prevalent, and wherever anopheles was found there malaria existed. In no place were the breeding-pools further from the houses than 150 yards. The breeding-pools were always easily localized, and were easily drained. From his observation of water containing both anopheles and culex larvæ, he thinks that the former frequently go under in the struggle for existence with the latter, and that this process of natural selection has an important bearing upon the question of freedom from malaria seen in certain districts. Fearnside succeeded in producing malaria in seven out of eight persons inoculated with the bite of infected anopheles, and found that the incubation period varied between twelve and twenty-five days.

Immunity to Malaria. Celli,¹ after referring to an article published by him last year, in which he showed that some individuals had a natural immunity against malaria, and having shown that artificial immunity could not be conferred by the diseased products of other animals or with the blood-serum or juices of organs of animals immune to malaria, nor yet by means of the "juices" of different infected or not infected mosquitoes, makes some further remarks upon immunity toward malaria. Of nine individuals whom he had observed for four years in the Pontine marshes, who seemed to have natural immunity toward malaria, two were this year taken ill, one with a slight attack of fever, which he quickly overcame, the other with a severe attack of æstivo-autumnal fever, although the latter patient was thirty-four years of age and had never previously had fever. The mode of life of these two patients had not been changed, and there was no apparent reason why they should suddenly have become ill with malaria. The observation of these two cases has led him to think that natural immunity is not so enduring as he had first thought, and he considers that artificial immunity is far more stable than the natural immunity. With Panichi he has been performing some experiments which are not yet completed, but, so far as they have proceeded, are as follows: If they injected a small quantity (from 20 to 50 c.cm.) of normal human blood-serum into an individual they found no alteration of the hæmoglobin value or the number of red cells. After injecting large or small quan-

¹ Centralblatt f. Bakt. Parasitenk. u. Infektionsk., February 28, 1901, p. 300.

tities (50 to 250 c.cm.) of blood-serum from a light tertian or æstivo-autumnal fever patient there was constantly an increase in the hæmoglobin contents and in the number of the erythrocytes. The temperature remained unaltered when doses of from 50 to 120 c.cm. were given, but after larger doses (150 to 250 c.cm.) there was a rise of temperature to 38.6° C. for a day or two. He states that after the injection of a small quantity (10 to 20 c.cm.) of normal ox-blood serum they also observed a slight increase of the hæmoglobin contents and the number of the erythrocytes. Further experiments showed that the blood-serum of the malarial patient, even when taken at the onset of a chill, had no more action in producing fever than had a very small quantity of normal ox-blood serum. He speaks favorably of the use of euchinine, in doses of one-half gramme daily, as a prophylactic. He mentions one case where an individual who had taken this dose of euchinine daily for eight days was then bitten by an infected anopheles, and then for ten days longer took the same dose, no fever resulting, although the anopheles was found to be filled with the malarial parasite.

"**Paludism without Malaria**" is the title of an article by Celli and Gasperini.¹ The authors studied from the newer stand-point, by blood examination, cases of marsh poisoning occurring in various parts of Tuscany, where the marshes still exist with stagnant canals—places that were known to be thoroughly "malarial." In the marsh-water they found many larvæ of anopheles, both claviger and pictus. Many mature insects were also found in the houses. Examination of these insects showed no difference from those found in regions typically malarial. Every year malarial patients came to this country, who through more or less obstinate relapses must have brought with them the plasmodium in their blood, many of these coming back after sojourning in Algiers, Corsica, Sardinia, and Rome, while others came back convalescent from military service. Malarial parasites were found in the blood of these returning individuals. In the past year the authors had seen three instances where one would certainly have expected at least a house epidemic of malaria, but in none of these was this result seen. The circumstances in these three instances were the return of patients with active parasites in the blood, the houses to which they returned containing numbers of anopheles, and uninfected individuals living in close association with the infected. The children who grow up in the marshes are strong and healthy. The parents are hollow-eyed, not because they have malaria, but because they suffer from pellagra. Not rarely old people are seen who in their many years have not suffered from fever, and a large number of the people, such as fishers, hunters, etc.,

¹ Centralblatt f. Bakt. Parasitenk. u. Infectiönsk., October 23, 1901, p. 523.

ordinarily live in the marshes without being attacked. By careful investigation the authors were able to say that in this marshy region, in spite of the fact that anopheles are present in large numbers, and that every year malaria cases come in from outside, malaria has been for some years absent. During this year only two sporadic cases were found at different places.

Interesting facts are given in regard to various portions of this marshy territory, some of which are as follows: In one place there was a household who were sick more or less every year, while in the neighboring houses there were numerous people living who were constantly healthy. In another district of 3000 persons dwelling in this marshy neighborhood there were only 30 cases of attacks of fever. In another place which was most conducive to malaria as far as its physical conformation went there were families consisting of 21 people, among whom there were only 5 attacks of fever, and of the 6 children none had suffered from fever. As the authors point out, everything was present to cause attacks. There was stagnant water, swarms of anopheles, and cases of relapsing malaria returning repeatedly with parasites in their blood. They believe that, aside from the factors just mentioned which were present in this region, there must be some other etiological factor producing the attacks, the nature of which factor has not as yet been thoroughly studied.

Even the convincing results of the careful and painstaking work already performed upon the subject of malaria and its mode of transmission do not thoroughly clear up the subject. The instances quoted by Celli and Gasperini of apparent immunity to infection in the midst of favorable surroundings are especially interesting when considered in connection with the reports of the commissions studying malaria in various parts of Africa during the past few years.

Experimental Inoculation by Mosquito Bites. Last year Manson's self-sacrificing work in subjecting himself to inoculation by malaria-infected mosquitoes was noted in the corresponding volume of *PROGRESSIVE MEDICINE*. A later report made by him¹ is particularly interesting, because of the known tendency to periodical evidence of malarial infection, even many months after the primary attack, without any distinct evidence of a re-infection. Manson's inoculation experiments were made on September 13, 1900. He had no recurrence of his trouble until May 30, 1901. He then experienced malaise and pain in the splenic region, and two days later had a definite malarial paroxysm, with chilly feelings, fever, and sweating, with enlargement and tenderness of the spleen. The blood obtained on this day showed

¹ British Medical Journal, July 13, 1901, p. 77.

a considerable number of specimens of the benign tertian parasite. Two days later there was a return of the paroxysm, and the organisms were again found in the blood. Treatment with quinine promptly caused a subsidence of the attack.

Malarial Nephritis. Ewing¹ has reported an extremely interesting case of malaria with acute nephritis, terminating fatally. The case was diagnosed as typhoid fever with acute nephritis. An autopsy was performed, and there was found an acute hemorrhagic nephritis. Examination of the kidneys showed peculiar pigmentation of the glomeruli and straight vessels, which suggested the possibility of the whole process being due to malarial infection. The white color of the surface of the kidneys was seen on close examination to be due to the collapsed condition of the cortical vessels. The convoluted tubules were filled with granular detritus, and the glomeruli contained a moderate number of pigmented cells and some parasites within the capillaries. There was marked erosion of the lining cells of all the tubules of the medulla, while in this region of the kidney the capillaries contained large numbers of infected red blood cells and pigmented parasites. The distended capillaries had in many places ruptured, giving rise to minute hemorrhages. The malarial parasites found corresponded to the full-grown forms of the *æstivo-autumnal* parasite. In the right kidney there was present a distinct infarct, evidently due to plugging by thrombi made up of infected red cells.

INFLUENZA.

Palatal Exanthem. Kolipinski² has described what he considers an early pathognomonic sign of epidemic influenza. This consists in the presence on the soft palate of small, convex projections of transparent, pearly white color, of about the size of a grain of sand. These varied in number, but were abundantly scattered over the whole anterior surface of the velum. On rubbing a spatula over the spots a rough sensation was transmitted. So far as I know this observation has not been confirmed. Of course, before the sign can be spoken of as being pathognomonic careful observations should be made as to the absence of a similar appearance in cases evidently not influenza. My own impression is that I have seen and felt spots corresponding to this description in cases suffering from various troubles. The value of the sign should be established or refuted during the next epidemic of this disease.

Complications of Influenza. BRONCHITIS in the course of influenza is dealt with by Forchheimer.³ After pointing out the indefinite knowl-

¹ American Journal of the Medical Sciences, October, 1901.

² Medical News, June 1, 1901, p. 858.

³ Ibid.

edge gained from bacteriological examinations of the expectoration in various forms of bronchitis, Forchheimer states that since the first epidemic of influenza he has repeatedly seen a bronchitis due apparently to streptococcus infection of the air-passages in combination with influenza, and that the same clinical picture was not presented in combination with any other general infection. Fifty-four cases were observed. His reason for calling the condition a streptococcic bronchitis is that in all of these cases this micro-organism predominated, and in quite a number it was the only bacterium found in the expectoration. It was found in all of the 54 cases; in 23 it was associated with staphylococci alone; in 3 with staphylococci and diplococci; in 1 case it was associated with the influenza bacillus, and in 27 it was the only organism found. Following an attack of influenza, the symptoms of influenza having subsided, the bronchitis begins rather suddenly, usually being fully developed in from twenty-four to forty-eight hours, with cough always spasmodic (see abstract of Forchheimer's former article, *PROGRESSIVE MEDICINE*, March, 1901, p. 139), especially annoying at night, causing pain in the head at the lower portion of the thorax and the abdominal muscles. Vomiting is not infrequent. The cough was usually followed by expectoration, the sputum varying from serous up to purulent, and being disproportionately small compared to the amount of cough. In a fair number of cases there was some blood mixed with the expectoration. From physical examination the inflammatory lesion would appear to chiefly concern the tubes of medium size. A large diurnal variation in temperature was noted, this being (as would be expected) more marked in children than in adults. In the cases wherein the blood was examined no change was found except in the more severe forms, where a moderate leucocytosis was present. Some of his cases showed the picture of septicæmia, with high range of temperature, sweats, and chilliness. Two fatal cases are narrated, in one of which a recent endocarditis was suspected, while in the other numerous hemorrhages were present. Curiously enough, there were but three cases of pneumonia in his series, a fact possibly explained by Forchheimer's statement that pneumonia is not so common in Cincinnati as in other parts of this country. Forchheimer strongly recommends in these cases the use of benzoate of sodium in large doses, 15 grains being given every two to four hours, combined with antipyrine or codeine if the cough be excessive, or with atropine or belladonna if the expectoration be too profuse. In the severer forms he employed, with good results, unguentum Cr  d   and injections of antistreptococcic serum.

MENINGITIS. The occurrence of nervous symptoms in the course of and following influenza has received a considerable amount of atten-

tion during recent years. Unfortunately for exact knowledge of the subject of this relationship but few of the cases show in the reports thereof that the influenza bacillus has been actually the cause of the symptoms. Two interesting cases of the association of cerebro-spinal symptoms with influenza were reported by Westcott two years ago.¹ While in the discussion of the paper some question was raised as to the propriety of speaking of these cases as instances of meningitis, there would seem to be very little doubt that, in spite of the absence of absolute proof by lumbar puncture, the association was one of influenza and meningitis. A case of meningitis, probably of influenzal origin, has been reported by Arthur F. Perigall.² A soldier, aged twenty-four years, was attacked with severe influenza on the night before he was seen by the reporter. His temperature was 103.6° F.; and he complained of pain in the back, legs, and head, especially behind the eyes. He was delirious, and on the next day the temperature was 102° F. Two attacks of epistaxis occurred. At the end of the week he was improving, but still had headache. The temperature remained at about 102.5° F., and there was occasional diarrhœa. Widal's test was negative. During the third week the temperature rose to 105° F., and there appeared a hard, red, erysipelatous swelling on the right cheek, which, after spreading to the right eye and over the nose, disappeared in three or four days. Pain continued constantly in the occiput, but there was no retraction of the head. After this incident of the third week the mental symptoms increased. He became stuporous, and developed a sudden right hemiplegia with aphasia, soon followed by complete paralysis, hæmatemesis, and death. At autopsy the lungs, kidneys, and stomach were "somewhat congested." Typical lesions of meningitis were found, evidently not tuberculous, but its nature cannot be determined from the fact that no bacteriological examinations were made. All of the other organs were normal. Of course, the question here arises as to whether this should be called a case of meningitis of influenzal origin. Undoubtedly the case was one of meningitis, but there is nothing in the report which would prove its influenzal nature. It is a pity that a bacteriological examination did not make it more certain in what category the case should be classed.

Rendu³ has also reported a case of cerebro-spinal meningitis supposed to be due to influenza. A child five years of age showed on the fifth day of an attack of influenza, stiffness of the neck and retraction of the head. On the sixth day of the illness opisthotonos and Kernig's sign were present. Five days later fever had begun, but there was par-

¹ Transactions of the American Pediatric Society, vol. xi. p. 230.

² Lancet, July 13, 1901.

³ Bull. et Mém. de la Soc. des Hôp. de Paris, 1901, No. 4.

alysis of both legs, with absence of the knee-jerks. Lumbar puncture was performed, followed by baths at 97° F. thrice daily, recovery gradually ensuing. The cerebro-spinal fluid obtained by puncture was clear, sterile, and showed an increased amount of albumin. A brother had had influenza just previously. In this case, also, it is of course a question whether the disease from which the patients primarily suffered was in truth influenza and not some non-specific infection. Nevertheless, the occurrence now of quite a large number of cases of this association of influenza with involvement of the cerebro-spinal meninges must make us consider that influenza is one of the possible causes not only of acute spinal meningitis, but also of poliomyelitis.

Meningitis occurring as a complication of influenza has also been reported by Carslaw.¹ Four cases are narrated, three ending fatally and one recovering. Only one of the fatal cases came to autopsy. In this case there was general purulent leptomeningitis over the convexity and at the base. In the purulent exudate there were found a few diplococci, although no growth was obtained on culture. In none of the cases is there quite definite evidence as to the cases being clinically influenza, although the difficulty of making an absolute diagnosis of this condition in the absence of bacteriological examination is, of course, readily conceded. It is to be regretted that in none of the cases, so far as can be seen from the reports, was any attempt made at lumbar puncture. While this very likely would not have given any more positive evidence of the influenzal origin of the meningitis, it would have decidedly added to the value of the report.

The reporting of what now amounts to quite a large number of cases of the supposed association of influenza and meningitis must cause us to consider influenzal infection as a possible cause not only of meningitis, but of acute inflammatory and chronic degenerative changes in the spinal cord.

POLYNEURITIS. Diemer² has written an interesting article upon the polyneuritis which occasionally follows influenza. He believes that all of the signs of neuritis are caused by toxæmia, but that the actual anatomical conditions are not known, as only one case has so far come to autopsy. The affection of the nerves begins usually during the period of convalescence. Sensory or motor troubles first appear, the latter persisting. The distribution of the neuritis is very irregular, any of the muscles being liable to attack. Muscular flaccidity is a very marked feature, and muscular atrophy is generally present, but is not very marked. The reactions of degenerations can be obtained, and ataxic phenomena are not infrequently noticed.

¹ British Medical Journal, January 12, 1901, p. 778.

² Gaz. hebdomadaire de Médecine, January 13, 1901.

Another case has been reported by Breton,¹ occurring in a woman, aged twenty-seven years, who had a decidedly neurotic history of several years' duration. During an attack of influenza she had paralysis of the legs, and evidence of polyneuritis appeared in the third to the fourth month after her influenza, and lasted for two months. The neuritis affected both the arms and legs, the left side being most involved. There was slight muscular atrophy.

ACUTE DILATATION OF THE HEART. A paper by Forchheimer upon acute dilatation of the heart in children during this disease was mentioned in the volume of *PROGRESSIVE MEDICINE* for March of last year. D. B. Lees,² in writing upon acute dilatation of the heart in various diseases, states that if the increase in cardiac dulness to the left of the nipple line does not exceed a finger's breadth there is but little danger, but if this extension to the left reaches two fingers' breadth there is real danger. Two illustrative cases are given.

SCARLET FEVER.

Statistics. An interesting statistical study of scarlet fever has been contributed by Somerset,³ based upon cases seen from 1893 to 1899, inclusive; 2627 cases were admitted to the Willard Parker and Riverside Hospitals. His conclusions show that the effects of the poison of scarlet fever become less marked and are of shorter duration the greater the age at which the patient is attacked. The mortality among the total number of cases was 9 per cent. The following complications were observed: Acute degeneration of the kidney occurred in 20 per cent.; cervical adenitis existed in 18 per cent.; inflammation of the ear in 8 per cent.; nephritis in 4 per cent.; arthritis in 4 per cent.; diffuse cervical cellulitis in 2 per cent.; myositis, endocarditis, pericarditis, bronchitis, and ulcerative tonsillitis each in less than 1 per cent. The average duration of the disease from the very onset to the completion of desquamation was from six to seven weeks.

Condition of the Blood. The condition of the blood in scarlet fever has been investigated by F. P. Mackie⁴ in twenty-five cases. Moderate anæmia was constant. In one-half of the cases the red cells were between 3,500,000 and 4,000,000. The highest count of the red cells was 4,170,000. The hæmoglobin was reduced in direct proportion to the diminution of the number of red cells. In all the cases there was a leucocytosis beyond 10,000, the number of leucocytes having apparently no relation to the height of the temperature. In most of the

¹ *Journal de Prat.*, February 2, 1901.

² *Brit. Med. Journ.*, January 5, 1901.

³ *New York Medical Journal*, vol. lxxii., No. 23.

⁴ *Lancet*, August 24, 1901.

cases the leucocytosis occurred about twenty-four hours after the appearance of the rash. In the anginal cases leucocytosis was very high; in one case the number of the leucocytes reached 95,300. The form chiefly affected by the increase was the multinuclear. The eosinophiles were increased to from 6 to 8 per cent. Mackie states positively that there is no leucocytosis until the rash has been present for about twenty-four hours.

Articular Complications. Homa¹ has studied 506 cases of scarlatina in the past five and a half years. Joint complications were present in 14 (2.8 per cent.) of these cases. They appeared at the end of the first week five times; at the beginning of the second week once; at the end of the second week four times; at the end of the third week three times; at the end of the fourth week once.

If fever were not already present the onset of the articular manifestations was accompanied with a rise of temperature. The symptoms diminished in a few days, but in six of the cases there was a relapse, and in one case two relapses occurred. The joints involved in his case showed the following order of prevalence: hand, elbow, knee, ankle, shoulder, and hip. As a rule, the various joints were affected at the same time. In only one case did suppuration occur.

CEREBRO-SPINAL MENINGITIS.

Modes of Infection. The question of infection by the meningococcus through the respiratory passage is discussed by Busquet.² The nasal mucus from patients suffering from epidemic cerebro-spinal meningitis was placed in the noses of guinea-pigs. All of the animals became infected, and from the cerebro-spinal fluid of those that died the meningococcus was cultivated. The nasal mucus from these animals was placed in the nose of other animals of the same species, and a similar result was obtained. Cerebro-spinal fluid obtained from patients suffering from the infection was placed on the nasal mucous membranes of animals, and similar pathological results were obtained.

In an article on dust as a vehicle for the germ of cerebro-spinal fever, Buchanan³ gives some interesting reasons for believing in the possibility of this factor in the spread of the disease. It was found that occupation had much to do with the incidence of the disease, those working in a dusty atmosphere furnishing a very large proportion of the cases. It was also seen that the dry months furnished practically all of the cases. The facts given in the paper are very suggestive.

¹ Wiener klin. Wochenschrift, 1901, No. 14, p. 281.

² La Presse Médicale, August 7, 1901.

³ British Medical Journal, September 14, 1901, p. 676.

Cases of Unusual Course. Three interesting cases of cerebro-spinal fever occurring in an epidemic involving sixty individuals are reported by Cannon.¹ One of these was an instance of arthritis, which complication was present in three or four of his sixty cases. The second case, a man, aged fifty-five years, without evidence of syphilis, had right-sided hemiplegia and aphasia, with paralysis of the bladder. At autopsy there was a thick, yellow, fibrinous exudate on the upper surface of both hemispheres, which was especially marked in the motor region of the left side. There was no hemorrhage and apparently no evidence of brain tumor at autopsy. His third case became unconscious shortly after taking food. He then vomited and became unconscious. Kernig's sign was well marked in both knees. The patient died three and a half hours after the onset of his attack. There was found diffuse leptomeningitis; the brain was intensely infiltrated with blood, and the fluid in the spinal canal looked almost like pure blood. In the cerebro-spinal fluid there was found the diplococcus intracellularis of Weichselbaum.

A discussion upon cerebro-spinal meningitis, apropos of a carefully studied case, is furnished by Brihoff.² The case forming the text of the paper was a woman, aged fifty-seven years, who was taken ill eight days before admission with symptoms of spinal meningitis. On admission she had crusts on the lips and nose, was comatose, and had tenderness over the spinal column, with other typical features of spinal meningitis. At autopsy the spinal dura was found tense and shining yellow in color. Incision of the dura gave exit to a flow of yellowish-green, turbid pus. The dura itself was injected and opaque throughout its whole course, as was also the pia mater. There was grayish-green infiltration of the spinal cord from the cervical to the lumbar region. The cerebral pia mater was also injected, and there was slight yellowish infiltration in the Sylvian fissure. In the fluid obtained by lumbar puncture during life many diplococci were obtained; some of these were within and some were outside the contained cells. Cultures, however, were absolutely negative. At the autopsy tubes containing blood-serum, glycerin agar, and agar were inoculated with the fluid from the spinal canal, from the base of the brain and the left ventricle. The results of the glycerin agar and agar inoculations were negative. On the blood-serum tubes the material obtained from the spinal canal gave colonies of Weichselbaum's diplococcus, as did also the inoculations from the ventricle. He believes that the meningococcus described by Weichselbaum is certainly a distinct and typical variety of pathogenic bacterium. He mentions, however, the very limited pathogenicity of

¹ Lancet, July 13, 1901.

² Münchener med. Wochenschrift, January 15, 1901.

the meningococcus, white mice being not at all affected, and guinea-pigs requiring enormous doses in order to kill them. He absolutely denies any causative influence to Fraenkel's diplococcus.

Lumbar Puncture. Nuttall and Hunter¹ have reported the results of lumbar puncture in ten cases of cerebro-spinal meningitis; nine of these were in children and one in an adult. Two slightly different forms of diplococci were found. In morphological and bacteriological characteristics they both corresponded to the diplococcus intracellularis of Weichselbaum. The two forms differed in certain minor respects, the type which they call *A* stained indefinitely and negatively by Gram's method, and showed on agar and glycerin agar a very delicate growth of almost transparent colonies; on gelatin a very delicate growth with no liquefaction. A slight growth occurred on bouillon; on stiffened blood-serum a growth similar to that on agar, and on potato a slight, invisible growth. On the other hand, the type which they described as type *B* was positive to Gram's method; gave a luxuriant growth of viscid colonies tending to run together on agar and glycerin agar; gave slight if any growth on gelatin, without liquefaction; gave a good growth, with marked turbidity, on bouillon, and on stiffened blood-serum a good growth of porcelain-like colonies, and on potato a good growth. In some cases the diplococcus was present in pure culture, but with some it was with the bacillus of influenza and that of tuberculosis. Clinically and pathologically the cases were instances of posterior basal meningitis, which they considered a sporadic form of cerebro-spinal meningitis and as being caused by the same organism, viz., the diplococcus intracellularis of Weichselbaum.

¹ British Medical Journal, September 21, 1901.

THE DISEASES OF CHILDREN.

By FLOYD M. CRANDALL, M.D.

THE NEWBORN INFANT.

Pathology of the Newborn. The number of papers relating to the newborn infant and the diseases of the first days of life was unusually large during the past year. While many of these were case reports, more than usual were devoted to general pathological conditions and treatment.

In writing upon the abnormal conditions of the newborn, Samuel Wolfe¹ divides the causes into seven groups: Premature birth, plural births, pressure on the umbilical cord, pressure on the head, pressure on the thorax, toxic conditions of the fœtal blood, and essential conditions of the fœtus. The most of these conditions result in asphyxia, one of the most serious symptoms which arise in the management of the newborn. The author refers to the various methods now in vogue for overcoming asphyxia, but neither he nor other writers of the year propose any materially new procedure.

The pathology of the newborn infant forms the subject of an excellent paper by F. W. Taylor.² Of 654 infants 64 presented some abnormal condition at birth or during the first days of life, 23 were stillborn, and 22 died within a few days. Of these 8 were premature, 5 were born of uræmic mothers, 1 developed purulent inflammation of the navel and died when five days old; 10 infants showed delayed respiration, but recovered; 6 of these were forceps cases, 2 were delivered by podalic version, and 2 had the cord around the neck.

Cyanosis. Besson³ reports cases which he denominates functional cyanosis, in which the cyanosis is marked and death seems imminent. He has treated three such cases by the use of the mustard bath, with most satisfactory results. When the cyanosis is not due to collapse of the lung or organic cardiac disease it would seem that such a procedure might be a useful one. A case of cyanosis, in a child aged

¹ Philadelphia Medical Journal, February 2, 1901.

² Boston Medical and Surgical Journal, April 11, 1901.

³ Journal des Sciences Médicales de Lille, May 11, 1901.

one year, was reported by Griffith.¹ The physical signs led him to believe that it was due to an abnormal arrangement of the bloodvessels and not to a patulous foramen ovale. In discussing this case Dr. Roberts said that in over two hundred autopsies he had found the foramen ovale open more or less in at least 40 per cent. He believed that unless extreme it could not be a cause of cyanosis, or that the condition would be far more common than it is.

Ophthalmia. In a study of 100 cases of this disease, Greenouw,² of Breslau, finds that all the inflammations of the eye in the newborn are due to micro-organisms, chiefly the gonococcus, pneumococcus, streptococcus pyogenes, and colon bacillus. Disease due to the gonococcus is usually marked by more copious discharge, and is more prolonged than that due to other bacteria, while damage to the cornea results almost solely from that germ. The presence of the gonococcus is a positive indication for some silver preparation. In several cases showing equal severity in both eyes, one eye was treated with nitrate of silver and the other with protargol. The results were practically the same. It seems probable, however, that the protargol in the strength used would be less irritating and less liable to do damage than the nitrate of silver if improperly used. Piotrowski³ has used protargol in 1030 cases. He cleanses the eye with a boric solution and drops in a 10 per cent. solution of protargol. He has not seen one case of ophthalmia. Catarrhal conditions were somewhat increased by the use of stronger solutions. It may be said that many prominent practitioners still cling to nitrate of silver according to the older method of Credé.

Melæna. This is one of the most common forms of hemorrhage observed in the newborn infant. Swoboda⁴ accepts the classification of true and false melæna, the blood coming from below the cardiac orifice of the stomach in the former and above in the latter. Clinically, this seems like a useless distinction. He speaks of the frequency with which meningeal hemorrhage occurs in cases of this kind. Adelaide Brown⁵ reports two cases in which hemorrhage from the bowel was the most urgent symptom. Excellent results seemed to follow the administration of gelatin. In the first case ergot was given and vomited, as was tincture of iron. An astringent enema was tried, but it caused an increase of bright blood. Gelatin was given and retained, and, with the addition of five drops of brandy every hour, was the only treatment persisted in. Gelatin tubes containing about one drachm were heated

¹ Archives of Pediatrics, May, 1901.

² Graefe's Archiv, February, 1901; American Journal of the Medical Sciences, May, 1901.

³ Centralblatt f. Gynäkologie, August 3, 1901.

⁴ Ibid., April 27, 1901.

⁵ Pediatrics, October 15, 1901.

and diluted and fed to the child. The effect was very perceptible. Gelatin was then given every two or three hours. In the second case only gelatin was tried. It was soaked and made of the consistency of wine jelly, and was fed to the infant, one drachm with five drops of brandy, every hour for twelve hours, then every two hours. There was no vomiting, and the hemorrhage decreased rapidly after the first doses. In both cases the infants were kept warm and absolutely still. The uniformity of the two results seems to indicate that there is some ground for the theory that unnatural fluidity of the blood is one cause of hemorrhagic disease of the newborn.

A case of vomiting of blood in a healthy child, aged twenty-four hours, was recently reported to me by Dr. J. F. Moore. Prompt relief was afforded by suprarenal extract administered in doses of one grain every hour until twelve doses were given. The parents had lost a child with the same symptoms two years before. A few weeks later another case of gastro-intestinal hemorrhage in a newborn infant occurred in the practice of the same physician. It was checked by the use of suprarenal extract, but the child died from cerebral hemorrhage. These cases have been reported by Holt,¹ who saw one of them in consultation. In discussing them, Morse said that he had tried the extract in powder without results. He referred to the importance of giving the drug in solution.

It is well known that melæna is a self-limited disease of short duration. If the hemorrhage can be temporarily checked there is hope that the child may survive the attack. The well-demonstrated power of suprarenal extract to check hemorrhage makes the suggestion of its use in this condition a most plausible one. No effect, of course, is to be expected when the hemorrhage is beyond the reach of its local application, as in the frequent complication of cerebral hemorrhage.

Hæmophilia. This is a very grave condition when it appears in infants. The various theories for its causation are discussed by Greef,² of New York. By this term is understood an hereditary tendency to hemorrhages which appear as the result of the most insignificant injuries. It occurs chiefly in the first years of life. No characteristic or constant lesions have been found upon autopsy, and it is impossible to make any positive statement as to its true character. The author is inclined to believe that it results from abnormal permeability of the vascular wall. From the stand-point of differential diagnosis there is only one condition to come under consideration, namely, melæna neonatorum. In melæna, however, the principal symptom is a discharge of blood from the gastro-intestinal tract, especially from the rectum. The

¹ American Medicine, June 8, 1901.

² Pediatrics, August 15, 1901.

author does not go further into the question of diagnosis, but it may be added that *melæna* is a comparatively transient condition, coming on during the first days or hours of life and resulting apparently from some infection, while *hæmophilia* is a constitutional condition and is usually persistent. Moragas¹ reports a case of hemorrhage in a girl, aged twenty-four days, in which the bleeding took place from fissures in the lips. He believes that any child with congenital debility is predisposed to *hæmophilia*, and slight traumatism during the first days of life may prove fatal. Slight wounds of the lips or mouth are especially prone to bleed freely, and call for prompt intervention.

Hemorrhagic Infection. Such a case is reported by Blumer² as due to the typhoid bacillus. The remarkable feature of the case was that the child, born at term, four and a half months after the mother had recovered from typhoid fever, had a convulsion on the third day, and death occurred on the ninth day. There was bleeding from the gums and other mucous surfaces, and the autopsy revealed hemorrhagic follicular colitis, with hemorrhages into various internal organs. Various sources of post-natal infections could be excluded, and it seemed probable that the typhoid bacilli had remained latent in the foetal tissues.

Intracranial Hemorrhage. This important condition is the subject of a paper by W. R. Wilson.³ The location of these hemorrhages may be extrameningeal, arachnoid, subarachnoid, ventricular, or mixed. Cerebral apoplexy proper is of rare occurrence in the newborn. Arachnoid and subarachnoid hemorrhages are by far the most common. The subarachnoid tissue consists of fine trabeculæ, not constituted to withstand injury; the veins are without muscular coat or valves. Obstruction of mechanical origin during birth may so increase venous pressure as to cause rupture and extravasation without any direct traumatism. Among the causes of such hemorrhage, therefore, are excessive or prolonged pressure on the head, torsion of the neck during forcible delivery, constriction or winding of the cord, or compression of the thorax. Prolonged labor is, therefore, an active cause of this serious condition.

The symptom-complex is usually as follows: Somnolence, anorexia, digestive disturbances with vomiting, piercing, hoarse, and fretful cry, contraction or dilatation of the pupils, and convulsions. The outcome is usually fatal, death being preceded by a condition of coma. The temperature is variable and irregular. Ordinarily a moderate rise, with irregular depression and exacerbation, continues until a few hours previous to death, when a sudden ante-mortem rise takes place. After

¹ *La Medicina de los Niños*, T. ii., No. 14; *Archives of Pediatrics*, July, 1901.

² *Journal of the American Medical Association*, December 29, 1900.

³ *Philadelphia Medical Journal*, February 2, 1901.

the shock and first symptoms the effects of cerebral depression are shown in paralysis, with spasm of all the extremities. Hemiplegia may occur as a possible consequence. Hyperæsthesia is a marked symptom. Central paralysis in a young infant is usually indicative of hemorrhage. In case of hemorrhage the fontanelle is bulging, owing to intracranial pressure, while in athrepsia and other conditions of defective nutrition there is depression. Permanent contractures, idiocy, and sensorial disturbances may be the final outcome.

TREATMENT. The primary object in treatment in hemorrhagic lesions occurring during birth and associated with asphyxia is to overcome the atelectasis by forced respiration. Schultz's method for the induction of artificial respiration—warm whiskey baths and inflation of the lungs by forced inspiration—should be resorted to. The infant should be regularly immersed in a warm bath (temperature 105° F.) at intervals of an hour. While in the bath the surface should be gently rubbed. In the intervals between bathing the infant should be enveloped in a light blanket, and heat should be applied to the lower extremities. An ice-cap should be constantly applied to the head. Small doses of sodium bromide (one-half grain) combined with tincture of digitalis (one-quarter minim) may be given at two-hour intervals.

Hemorrhage into the Suprarenal Capsule. Hamill,¹ in an extended paper on "Hemorrhage into the Suprarenal Capsule in Stillborn Infants," gives the history of ninety cases collected from the literature, and reviews the subject *in extenso*. At least a dozen causes have been given for this accident. The most common of these, the author believes, are prolonged and difficult labors, those requiring manipulation and especially those requiring delivery by the breech. In some infants dying a few days after birth the lesion may still be attributable to injuries inflicted during labor; but in a vast majority of these some form of infection is responsible, while in practically all cases dying after the tenth day some form of infection produces the condition. The following classification seems to Hamill the most appropriate: (1) Those in which death occurs before or during labor, due chiefly to traumatism from manipulation; (2) those in which it occurs between birth and the detachment of the stump, due chiefly to infection through the cord; and (3) those dying after the detachment of the cord, usually of an infectious or toxic origin.

Infection through the Navel. This is an accident of not infrequent occurrence. It is always serious and usually fatal. Wassermann² reports eleven fatal cases. The umbilical arteries were found filled

¹ Archives of Pediatrics, February and March, 1901.

² Virchow's Archiv, Band clxv., Heft 2.

with pus and thrombi. Pneumonia was present in seven cases. In four cases in which bacterial study was made a germ apparently identical with the bacillus pyocyaneus was found. The use of thick catgut for tying the cord is advocated by Leube.¹ The cord is then cut off just above the ligature and covered with diachylon powder.

Gangrene. Bowes² reports a case of gangrene appearing in a perfectly healthy infant on the sixteenth day. A small vesicle appeared in the lumbar region, which soon burst, leaving a circular ulcer, and this in turn was gradually surrounded by a gangrenous zone extending from the sacrum to the scapula. As the author was able to find no traumatism or other cause, he reports it as a case of spontaneous gangrene. The child died of exhaustion. Bronson³ reports a case of gangrene of the face, due possibly to pressure. The gangrenous process involved the cheek and neck and a part of the forehead. The process was a superficial one. The slough separated after ten days, and the wound healed in six weeks. It could not have been due to the action of carbolic acid or lysol, as neither was used.

Respiratory Failure. Two peculiar cases of respiratory failure in newborn infants are reported by Snow,⁴ of Buffalo. Both children were born after normal labor, and for the first few days were in perfect health. Suddenly they developed a peculiar group of symptoms, the chief of which was a failure of respiration associated with opisthotonos. The first child recovered after symptoms of a very urgent nature had continued for twenty-six hours. The second child died after fourteen and a half hours, but no autopsy could be made. A singular case has been reported by Keefe,⁵ in which the respiratory failure and cyanosis were very severe for fourteen and a half hours; cyanosis, with fever, continued for about seventy-two hours longer. Keefe reported another case in 1897, occurring in a four-weeks-old child suffering, with several other member of the same family, from influenza. The baby had been ill four and a half days with grip; suddenly it became cyanotic and breathed superficially. It was revived by heat and stimulation. There were twenty-seven such attacks before the child recovered. Snow believes that the attacks of apnoea were due to pressure on the medulla, the rapid clearing up pointing to congestion or slight oedema.

Epiphyseal Separation. This condition is not an uncommon one in infants suffering from congenital syphilis. The subject is discussed by Labbe,⁶ who found it present in 5 per cent. of his cases. It comes on insidiously, pain and loss of motion being the earliest symptoms.

¹ Centralblatt f. Gynäkologie, July 6, 1901.

² Lancet, August 31, 1901.

³ Journal of Cutaneous and Genito-Urinary Diseases, October 19, 1901.

⁴ Archives of Pediatrics, October, 1901.

⁵ Lancet, November 24, 1901.

⁶ Presse Médicale, No. 79, 1901.

The upper end of the humerus is the region most frequently affected. Under suitable mercurial treatment recovery is quite possible.

Feeble and Premature Infants. The statement has recently been made that among the 2,800,000 births annually in the United States there are 420,000 feeble and premature infants. For children very feeble at birth there can be no question as to the value of the incubator. By its use Tarnier saved 16 per cent. of his cases born at six months, and none without it; 36 per cent. at six and a half months, and 21 per cent. without it; 49 per cent. at seven months, and 39 per cent. without it. At the Sloan Hospital of New York 66 per cent. were saved at six and a half months, and 22 per cent. without its use; 71 per cent. were saved with it at seven months, and 41 per cent. without it. After seven months all statistics show much less difference in the results. Deutsche believes the incubator had best be used when the weight is below four pounds and the age below seven months. Holt believes it is indicated at below seven months with a weight of three and a half pounds and a length of less than nineteen inches.

In a recent article¹ I considered the management of feeble infants, but not those so delicate as to require the incubator. Protection from cold is a matter of vital importance. No attempt should be made to dress the child, but it should be well wrapped in cotton. Absorbent cotton is to be preferred, but if expense be an objection a thin layer of absorbent cotton may be used at first and cotton batting placed over it. A thin layer of cotton should be placed between the arms and the body, to prevent chafing, and a small pad of absorbent cotton should be placed about the buttocks. Having applied the cotton, a soft flannel blanket should be placed over all and fastened with safety pins. The head is the only part of the body that is left exposed. This should be covered by a soft flannel blanket or a little flannel cap. The child should be rubbed freely with oil, which takes the place of a bath without the danger of chilling. If the child is exhausted by nursing, feeding with a medicine dropper is an excellent idea. At seven months a child will sometimes not take more than a drachm at a feeding every hour. Breast milk should be given when possible. At first it may be drawn with a pump and administered with a medicine dropper.

Townsend² reports in detail the feeding of an incubator baby. The top milk consisted of the upper eight ounces from a quart of milk which had stood five hours. A very weak mixture was given at the first, as follows: Top milk, 1 ounce; water, 18 ounces; lime-water, 1 ounce; sugar of milk, 2 tablespoonfuls; or, approximately, fat, 0.50;

¹ International Medical Magazine, July, 1901.

² Archives of Pediatrics, October, 1901.

sugar, 4.20 ; albuminoids, 0.20 ; 1 drachm was given every hour of the day ; 2 drachms every two hours during the night. The strength of this mixture was gradually increased by adding 1 ounce more of top milk and 1 ounce less of water, until on the seventh day it was as follows : Top milk, 5 ounces ; water, 14 ounces ; lime-water, one ounce ; sugar of milk, 2 tablespoonfuls ; or, fat, 2.50 ; sugar, 5 ; albuminoids, 1.

As 8 ounces from the top of ordinary milk will yield 14 per cent. of fat instead of 10 per cent., as Townsend evidently estimates, I would suggest that 11 ounces be taken. Even then the last formula will be rather strong for some weakly babies.

NUTRITION—HYGIENE.

The Temperature in Health. A series of observations upon the temperature of children is reported by Donald.¹ Twenty children were under close observation for fourteen days, and the most obvious peculiarities were : First, the instability of the normal temperature ; second, its variability ; third, the individual peculiarity in some children of a tendency to maintain a constant high temperature—a temperature, in fact, which in other children would be considered as indicating a pyrexia ; fourth, a tendency, which is already well known, of normal temperatures in normal children to run higher than normal temperatures in adults.

The Pulse. After some carefully conducted observations upon the sphygmographic appearances of the pulse in infancy, Nicholson² reaches the following conclusions : 1. The sphygmogram of the newborn child is not the simple type of curve described by standard authorities. 2. It shows a distinct percussion wave, which forms a pointed summit to the curve, with presence of the secondary wave, in the majority of cases. 3. It reveals all the characters of a relatively high-tension pulse. 4. Dicrotism is present in the infantile as in any high-tension pulse. 5. The summit of the pulse-curve becomes more and more pointed, and the secondary waves are accentuated during the first year of life, but the pulse still remains of moderately high tension. 6. Febrile movement in children under a year old very rarely produces dicrotism or hyperdicrotism of the pulse.

School Hygiene. A symposium on this subject was held at the last meeting of the American Medical Association. L. K. Baker³ opened the discussion with the proposition that the nations that have exercised

¹ Archives of Pediatrics, March 2, 1901.

² Scottish Medical and Surgical Journal, vol. viii., No. 5.

³ New York Medical Journal, July 13, 1901.

the most powerful and elevating influence have been those who have exercised the most care for the health of their children. In a democracy, self-preservation demands an educated citizenship. It is also the duty of the State to insist that the physical basis in the educational structure shall be adequately and properly laid. It is conjointly the duty of the State, the parent, and the medical profession to see that the schools and their surroundings are what they should be, and that the teaching force and school boards consist of the right individuals. Baker outlines a systematic plan of organization, and points out the dangers of allowing political interests to enter into the management of the schools. He insists particularly upon the regular medical examination of school-children. J. M. Taylor¹ contributes a paper upon physical culture in children and the objects to be obtained. Another excellent paper is that of W. E. Darnall² upon the pubescent school-girl. He speaks particularly of the evil effect of unhygienic, close-fitting garments, with skirts suspended from the waist instead of the shoulders, and the effect of ill-fitting corsets. She is fitted to a corset, as a rule, and not the corset to her. Work³ spoke of the two important factors of dress—equal pressure and equal warmth—which are so commonly ignored in clothing children, particularly girls. The importance of regular habits in eating, elimination, and bathing was also discussed. He asserted that troubles which are so often attributed to the school system are due in considerable measure to the mother, and not to the school. There is urgent need of trained mothers, and it is the duty of the medical profession to educate the mothers of the community how to care for the health of their school-children.

Deficient and Backward Children. In the discussion upon school hygiene, already referred to, A. W. Wilmarth⁴ presented an excellent paper upon the diagnosis of backward children. He asserted that no one standard of mental activity can be fixed. The estimate of mental strength must be formed from the power of attention, the strength of memory, and efficiency in the method of reasoning known as "common sense." On the other hand, abnormally slow perception, lack of power to fix attention, distorted judgment, feeble memory, or decided lack of moral sense are mental symptoms which should place the subject in the backward class. The lack of articulate speech is perhaps the most significant symptom indicative of lack of mental growth. Gait and posture are of some value when taken in connection with other symptoms. The lack of moral sense is so radical a defect that one is forced to regard it as a perversion of mental development.

¹ New York Medical Journal, July 13, 1901.

² Ibid., July 20, 1901.

³ Ibid.

⁴ Ibid.

The first thing in the development of the child's brain is the awakening of the power of attention. Without this all attempts at education are futile. Next come memory and inquisitiveness. The will-power later exhibits itself, then the reasoning power, the value of ideas, and respect for the rights of others. A child may have a weak memory and make a poor showing in school, and yet have acute reasoning powers and the ability to make good use of what he does learn. Such a child should not be classed as backward.

Speech as a factor in the backwardness of children is referred to by G. H. Makuen.¹ Speech is a tool of the mind. Children are dependent upon it for the normal development of their faculties, and the best method of arriving at a prognosis is to apply the speech-test or ascertain to what extent the faculty of speech may be improved. It will be found usually that those who are susceptible to training in what may be called the refinements of speech are the ones who give promise of the best results. C. F. Wahrer² spoke against the error of hasty judgment. The very bright child, with good memory and power of expression, is often taken as the standard, instead of the medium child. There is often nothing the matter with the child who is considered slow. His powers are latent and may be developing in a different direction from the course expected. The mistake may be made of rating high the child with good memory, but of ephemeral mental development, and giving a low estimate for the duller, slow pupil of far better mind.

The subject of dull and deficient children was also the topic for discussion at a recent meeting of the New York Academy of Medicine.³ W. B. Noyes said that for purposes of education it had been proposed to classify children as follows: 1. Those who are more or less of an automatic type. 2. Those who respond most readily to suggestion when their emotions are appealed to. 3. Those who are not often readily influenced by suggestion except by exciting in them a spirit of opposition. 4. Rebellious and obstinate children and those who are degenerates or moral perverts. In studying mentally defective children one would meet with the following important classes: 1. Those who have defects of perception, *e. g.*, the deaf, dumb, and blind. 2. Those who lack the power of attention. 3. Those exhibiting defect or disorder of the will. 4. Those who are morally defective.

Pierce Bailey⁴ presented a paper on the etiology of mental deficiency. He looked upon idiocy, imbecility, and feeble-mindedness as different forms of the same condition. The disastrous effects of alcohol on the developing ovum had been demonstrated experimentally; but, in his

¹ New York Medical Journal, July 20, 1901.

² Archives of Pediatrics, July, 1901.

³ *Ibid.*

⁴ *Ibid.*

experience, while the progeny of alcoholics were of unstable nervous organization he had not found idiocy especially common among them. C. S. Bull¹ discussed dulness due to eye defects. He said that defective vision was a very important form of apparent mental dulness. The difficulty experienced by hypermetropic children in sustaining the accommodative effort necessary for near vision led them to be slow and to appear dull. Astigmatism was another common defect of the eye important in this connection, but by far the most important was myopia. He would commend to earnest attention the fact that the number of shortsighted pupils increases from the lowest to the highest grades in our schools, and is in direct proportion to the hours of study.

L. M. Yale² called attention to the tendency of children to develop like their parents, and added that parents who in childhood had been slow in development seemed to forget this fact in the success achieved subsequently, and were disposed to demand of their children greater mental activity and more rapid development. T. MacNicholl³ gave some of the results of an investigation he had conducted with reference to heredity to mental deficiency. Of 10,000 children, 8.8 per cent. showed more or less mental deficiency. He had traced 463 children, in 150 different families through three generations. Of this number, 17 were precocious in some one thing; 403 were generally deficient; 313 had drunken fathers, and 51 had drunken mothers; 265 had intemperate grandparents, and 246 had intemperate parents as well as grandparents. A study of 51 strictly temperate families, with 231 children, showed less than 3 per cent. of dull children.

It is asserted by Fletcher Beach⁴ that the proper education of feeble-minded children is the education of the senses. He refers particularly to the sense of touch, which in these children is more than usually dull. They do not suffer pain to the same extent as do normal children. The co-ordination of the finer muscular movements is especially to be sought for, hence kindergarten training is particularly serviceable. A paper on the city's obligation to provide special education for defective children, by E. C. Meleney,⁵ Associate Superintendent of Schools of New York City, is worthy of the careful consideration of medical men and legislators. He refers to the special classes, such as the blind, deaf, and imbecile, who, it is well recognized, need special schools. Another class, commonly known to the teacher as dullards, when classed with the normal children usually fare poorly, often fail of promotion, and leave school as soon as the law allows. In many cases the dul-

¹ Archives of Pediatrics, July, 1901.

² Ibid.

³ Ibid.

⁴ Journal of the American Medical Association, January 12, 1901.

⁵ Philadelphia Medical Journal, July 13, 1901.

ness is due to causes that might be removed by special sense training, or by the use of special methods. Provision should be made for the expert examination of such children and appropriate treatment. There are two main reasons why such differentiation should be made. First, the interest of the unfortunate pupils themselves; second, the interest of the normal children and of the teachers, whose entire time is required for the instruction of the average children. The improved results in the regular classes, to be accomplished after the elimination of defective children, would more than pay the cost of rooms, appliances, and teachers of the latter class. Meleney believes in keeping children in their natural environment as much as possible, and in teaching them to adapt themselves to the environment in which they live. A child who is deaf, dumb, blind, or feeble-minded will have to live with people, and should learn, if possible, how to communicate with them.

INFANT FEEDING.

The contributions upon this subject have been, as usual, large in number. Comparatively little has appeared upon the chemistry of milk, more attention being devoted to practical modification, and particularly to home modification. Southworth¹ makes a strong plea for the conservation of breast-milk in whole or in part. He alleges that 97 per cent. of infant mortality from gastro-intestinal disease occurs among infants not exclusively breast-fed. In Germany the official statistics show that 51 per cent. of artificially fed children die during the first year, as opposed to 8 per cent. of those nursed. He justly urges that it is the duty of the attending physician to instruct mothers as to diet, exercise, and proper methods of nursing. He refers to milk, gruel, and cocoa as having special nutritive and milk-making qualities.

If it is certain that a child must be artificially fed, it is of great importance that the diet be started right. An attack of indigestion is a serious misfortune to a child; the younger the child the greater the misfortune. A few days of improper feeding may so derange the digestive processes that the infant may not regain its normal digestive power for weeks. In a brief article,² therefore, I strongly urged the importance of starting the baby's diet right. It is best to decide as quickly as possible whether the child is to be nursed or artificially fed, for valuable time is often lost in indecision and futile attempts at maternal nursing.

One of the best papers of the year upon home modification of cow's

¹ Medical Record, May 4, 1901.

² International Medical Magazine, February, 1901.

milk is that of Holt.¹ He begins with the assertion that the nutrition of infants is easy only on paper. He refers to the large number of failures of maternal nursing and to the difficulties experienced in obtaining satisfactory wet-nurses. These facts should not be forgotten when we consider the difficulties of artificial feeding. Percentage feeding is frequently misunderstood. It is simply a method of statement of what to do. Several tables are given and numerous formulas for making mixtures of various percentages. Upon the question of milk-sugar Holt is particularly clear. The range required in the modification of milk is usually between 5 per cent. and 7 per cent. In estimating the quantity to be added to bring up the proportion to this amount account must be taken of the sugar already present in the milk. Except for mixtures with proteids above 2 per cent., 1 ounce of sugar to 20 ounces of the mixture will give very nearly the percentage required, viz., about 5 per cent. for the lower mixtures and 7 per cent. for the higher ones. This embraces nearly all the formulas required for the first ten months. It is impossible to give further details of the methods proposed by Holt without quoting a large number of tables and formulas. In speaking before the Philadelphia Pediatric Society upon some forms of indigestion in young children, with special reference to their dietetic treatment, Holt² emphasized the following points: 1. The simplicity of the question of feeding infants when they possess healthy organs and the complexity of the problem when these organs are deranged. 2. The comfort of the infant is the guide as to the correctness of the feeding. 3. No mother should nurse an infant which has persistent indigestion and does not gain in weight. 4. If there is a gain in weight, then try to overcome the indigestion. 5. There is no more troublesome symptom than vomiting, which is due in the large majority of cases to too large an amount of fat. 6. Too much attention should not be paid to traditional opinions regarding the amount of fat, proteids, etc.

In writing upon cereals, emulsions, and proteids, Rotch³ reports the experiments of White and Ladd, which show that barley-water mixtures differ from other mixtures in giving a slightly finer coagulum with hydrochloric acid and rennet. His conclusions, however, as to the addition of cereals to cow's milk for young infants are that such addition is unnecessary. As to the disturbance of the emulsion of milk by laboratory modification, only a very small portion of the emulsion is disturbed, and in Rotch's experience he has never been able to see that it did any harm. As to proteids, the total amount in all milk is prac-

¹ New York Medical Journal, January 12, 1901.

² Archives of Pediatrics, July, 1901.

³ New York Medical Journal, January 26, 1901.

tically made up of caseinogen and whey proteids. According to the analysis of Koenig, the proportion of whey proteids to caseinogen in human milk is about 2 to 1, while in cow's milk it is about 1 to 5. If we wish to prescribe a total proteid of 0.75 we should theoretically write our prescription for whey proteid 0.50 and caseinogen 0.25. At Rotch's request the laboratories have made calculations by which these proteids may be given as desired, by the use of milk and whey. The subject requires much more study and elaboration.

The question as to the use of cereals has been much discussed for two or three years past. Chapin¹ maintains even more strongly than in former years his position regarding predigested gruels. He holds that chemical analyses of milk are not the only scientific bases of comparison; that as cow's milk forms solid curds and woman's milk flocculent curds, the curds of cow's milk intended for an infant should be broken up mechanically; that as cereal gruels mechanically break up the curds of cow's milk, and as infants are able to utilize them, their use is rational. Chapin,² in another excellent article, elaborates somewhat the methods already proposed by him which I considered *in extenso* in these pages last year.

An article by Northrup³ reviews the subject of milk modification by the laboratory. In closing he says that a long and full experience with laboratory feeding constrains him to say that he regards the modern well-equipped laboratory as one of the greatest additions that has come to the pediatricist, deserving to be ranked with diphtheria antitoxin and intubation. In an article upon exact infant feeding the same author⁴ summarizes his belief as follows: 1. Clean cow's milk modified to some definite standard is demanded. 2. A laboratory for modification is desirable; it secures greater exactness and cleanliness. 3. The physician should frequently revise his formula; frequent small percentages of increase are to be advised. 4. Accidents may arise from consigning an infant for several months to insufficient food ingredients.

The last new suggestion in the modification of cow's milk is the differential modification of the proteid. The last and most extended paper upon the subject is that of Westcott.⁵ Until recently the total proteids alone have been considered, but it is well known that the relative proportions of lactalbumin and caseinogen are totally different in breast milk and cow's milk. The attempt is being made, therefore, to differentiate these proteids, as mentioned on a preceding page. Westcott's article is an extremely interesting one, as it makes use of a

¹ New York Medical Record, July 6, 1901.

² New York Med. Journ., February 23, 1901.

³ Ibid., March 16, 1901.

⁴ Journal of the American Medical Association.

⁵ American Journal of the Medical Sciences, October, 1901.

large number of formulas and tables of analysis. It is so intricate, however, that it is impossible to present a satisfactory résumé within the limits of these pages. This differential modification is not offered as a panacea for all the difficulties of infant feeding; failures have occurred, but they have proved exceptions to the general rule.

The importance of beginning with a very dilute milk mixture in babies fed artificially from birth is urged by Kerley.¹ On the third day he advises 1 per cent. fat, 4.5 per cent. sugar, and 0.4 per cent. proteid. He offers a method of feeding in which two quart bottles of milk are required. From the top of one all the cream is removed. The other bottle is well shaken before it is opened, and from this bottle the whole milk is used. The cream contains approximately the following percentages: Fat, 16 per cent.; sugar, 3.2 per cent.; proteid, 3.2 per cent. The full milk contains: Fat, 4 per cent.; sugar, 4 per cent.; proteid, 4 per cent. The system consists in combining these two elements with water, a 1-pint mixture being taken as the standard. For example, a mixture of 2 ounces of milk and 14 ounces of water will contain 0.5 per cent. each of fat, sugar, and proteid. Two ounces of cream and 14 ounces of water would yield 2 per cent. fat, 0.4 per cent. sugar, and 0.4 per cent. proteid. By combining these, 2 ounces each of cream and milk with 12 ounces of water would yield: Fat, 2.50 per cent.; sugar, 0.9 per cent.; proteid, 0.9 per cent. Nine sample formulas are given. It has not been Kerley's experience that peptonizing renders it possible for a child to take a greater amount of proteid. He prefers the use of dextrinized gruel. For children who are unable to digest cow's milk proteid he proposes a method of differential modification, as follows: Mother's milk contains about 1 per cent. of lactalbumin and 0.5 per cent. casein; cow's milk contains about 3 per cent. casein and 1 per cent. lactalbumin. It is this large amount of casein which gives the trouble. For delicate infants it must be removed. This is accomplished by the use of rennet or pepsin and moderate heat. The milk is converted into curds and whey. The coagulated casein is removed; the whey contains about 1 per cent. of fat, 1 per cent. of lactalbumin, and 4 per cent. of sugar. This gives us a food weak in fat, but with a proteid which is exceedingly easy of digestion. The fat is increased as soon as possible by the use of cream.

A few years ago the efforts of all who wrote upon infant feeding seemed directed toward obtaining minute percentage changes. The methods proposed were very cumbersome, and involved either intricate computations or the memorizing or copying of numerous formulas. Almost every writer used formulas, a course which practically made

¹ New York Medical Record, August 31, 1901.

modified milk nothing more than a series of mixtures. Many practitioners have, therefore, given up percentage feeding in despair, and have resorted to proprietary foods, condensed milk, or old and obsolete methods.

In view of these facts I attempted¹ to present the subject in a form that could be used without the learning of complex methods or consulting text-books and formulas. It is based upon the principle that in all milk, whether rich or poor, within reasonable limits, the top 9 ounces of cream and skim milk from a quart contains fat three times the proteids. The top 15 ounces contain fat two times the proteids. Hence, between these 9 and 15 ounces we can get fat anywhere from two to three times the proteids, which is the range in woman's milk. By using a 1-ounce dipper devised by Chapin² for removing the top milk twenty-five different ratios between fat and proteids can be obtained from one quart of milk.

It has been very truly said by Holt that too much attention should not be paid to traditional opinions regarding the amount of fat and proteids in formulas, as the comfort of the child should be the real guide in any system of feeding. This idea, therefore, I embodied in my paper. The one object in modifying milk is to obtain a mixture upon which the infant will thrive. A pediatric specialist of large experience will find such a mixture more quickly than will a general practitioner with small experience, but specialists have no secret process; they try combinations. If they have any secret, it is a very open one, and may be thus expressed: *Begin on a weak mixture and work up to the point of tolerance.* The average practitioner does precisely the opposite. He begins on a mixture too strong, and after weeks of indigestion gradually works down to the point of tolerance. He is afraid to dilute the milk sufficiently at the outset. If we begin with a weak preparation we find what the child can take, and that is successful feeding. We reach that practical result whether the milk be high or low in fat and proteid. We give the child what it can digest and thrive on. The following table will explain more clearly the statements regarding the proportion of fat and proteids in the upper 9 or 15 ounces of milk and cream. It is based upon milk containing 4 per cent. each of fat and proteid.

	Per cent. fat.	Per cent. proteid.
8 ounces top milk contain	14	4
9 ounces top milk contain	12	4
11 ounces top milk contain	10	4
15 ounces top milk contain	8	4
20 ounces top milk contain	6	4

¹ Medical News, May 11, 1901.

² PROGRESSIVE MEDICINE, March, 1901.

These top milks simply require diluting three to ten times. When the milk is to be well diluted the top 9 ounces are commonly required; as the dilution is reduced, 12 to 15 ounces. For example, dilute 9 ounces of top milk to one-fourth, and we have 3 per cent. fat and 1 per cent. proteid. Dilute 15 ounces of milk to one-half, and we have 4 per cent. fat and 2 per cent. proteid. For a young infant, dilute 9 ounces of top milk eight times, and we have 1.5 per cent. fat and 0.5 per cent. proteid. With the same diminution, if we take off 2 ounces less (7 ounces top milk) we have 2 per cent. fat and the same proteid. Take 2 ounces more (11 ounces top milk) and we have 1.25 per cent. of fat and the same proteid. We thus regulate the proteid by diluting; the fat by the amount taken from the top. Simply divide the figures of this table by the number of times the milk is diluted, and the percentage of the fat and the proteid in the mixture is known. The claim is not made that this will result in the same absolute percentages in every milk. No modification can do that unless the quality of the milk is known. It will, however, be as accurate as any method of home modification can be. While it is desirable that the practitioner should know just what percentage the infant is getting, he can prescribe satisfactorily if he will begin low and work up slowly by taking gradually less from the top of the milk, or diluting it less, thus changing the fat or proteid as he desires. If the whole amount of top milk is not required it should still be dipped off. For example, if the child is to have twenty-four ounces of food, of which one-fourth is to be 9-ounce top milk, we use 6 ounces of the latter and return 3 ounces to the bottle. This point must be explained to the mother, or she may take off but the 6 ounces required, thus increasing the amount of fat by 50 per cent.

Having obtained the requisite percentage of fat and proteid, we must add sugar. This is made very easy by the fact, recently pointed out by Holt, that for mixtures below 2 per cent. of proteids 1 ounce of sugar to 20 ounces of mixture, with the sugar already in the milk, will give the percentage required in almost every formula for the first ten months. An ounce measure will hold two-thirds of an ounce of milk-sugar by weight. If measured by a tablespoon, 2 level tablespoonfuls of granulated sugar, or almost 3 tablespoonfuls of milk-sugar, equal 1 ounce. Milk-sugar should be used when possible. When cane-sugar is used the percentage should not be as great as for milk-sugar.

We can readily obtain percentages if we wish to begin with a percentage prescription. Suppose we wish to make a mixture containing fat, sugar, and proteids in the proportion of 4, 7, and 2. To get 2 per cent. of proteid we must divide the 4 per cent. proteid of top milk by 2. We then require a top milk containing twice the amount of fat

desired, or 8 per cent. This we obtain by taking 15 ounces of top milk and diluting it to one-half; that is, we divide the proteid by 2 and find a top milk which, divided by 2, will give the desired amount of fat.

The question of sterilization and pasteurization of milk is still somewhat discussed. Blackader¹ presents the most satisfactory article which has appeared for some time. He quotes largely from various authorities, and bases his conclusions partially upon communications received from leading specialists. These conclusions are: That milk sterilized by heat is altered to an extent varying with the elevation of the temperature and the duration of the exposure in the following respects: 1. Its proteids are modified and rendered apparently less digestible, but our knowledge on this subject is still indefinite. 2. The combination of its saline ingredients with the proteids, which we must admit is not absolutely proved, is more or less broken and the salts are less readily absorbed. 3. Natural ferments, whose presence in milk may with much probability be inferred, and which may materially assist its digestion in the infant's stomach, are destroyed. 4. An alteration takes place in the emulsion, normal to milk, which may also have an effect in lessening its digestibility. It appears to Blackader, therefore, extremely desirable to use fresh milk drawn with such careful precautions as to be practically free from extraneous bacteria, and in which the lactic-acid producing bacteria are present in such small numbers as to induce no alterations of moment. Such milk is better not sterilized at all; but it is seldom our good fortune to obtain such milk with the regularity necessary for the daily preparation of an infant's food. When the supply cannot be depended upon, it appears the lesser of two evils to have the milk sterilized at the lowest efficient temperature, namely, 60° C., for fifteen minutes.

Freeman,² whose opinion upon this subject is of great value, holds that the ideal substitute food should be fresh, raw, and with but few bacteria. But such milk is not generally obtainable in the market. He affirms that pasteurization at 68° C. (155° F.) for thirty minutes destroys most of the bacteria, including tuberculosis, typhoid fever, and diphtheria, and causes practically no chemical change in the milk, not even changing its taste. Between boiling, which injures the milk, and pasteurization, which does not, we should choose the latter.

Milk: Its Production and Use as an Infant Food. Much has been written during the year upon the production of milk, and much practical work has been done in improving the milk-supply of the

¹ New York Medical Journal, February 2, 1901.

² Archives of Pediatrics, January, 1901.

larger cities of this country as well as some of those abroad. Regarding the theoretical requirements to attain this end but little has been proposed that is new. Practical results, however, are unusually manifest. The two most notable attempts, perhaps, to improve a general milk-supply have been those instituted by the Philadelphia Pediatric Society and the New York County Medical Society. Commissions were appointed by each, designed to investigate the character of the milk obtained from various dairies and to supervise its method of production and transportation. A certificate is given to those dealers who comply with certain specified requirements. The standard required by the New York Milk Commission is that the acidity must not exceed 3 per cent., the milk must not contain over 30,000 bacterial germs per cubic centimetre, and butter fat must reach 3.5 per cent. Of twenty samples examined November 1st the lowest number of germs was 90,000 and the highest 2,280,000; on June 29, with the thermometer at 90° F., of twenty samples the lowest contained 240,000 and the highest 516,000 germs per cubic centimetre.

A most encouraging feature of the work in New York was the readiness and even anxiety of some of the leading dealers to profit by the advice of the commission and to fulfil the requirements proposed by it. Another most encouraging feature was the prompt and decided improvement in the milk, as shown by bacterial examination in numerous cases in which the dairymen undertook to follow the commission's suggestions. It is probably a fact that more has actually been done during the past year to improve the milk-supply than in any year previous.

An interesting paper is that of G. M. Kober,¹ based upon 330 outbreaks of infectious diseases spread through the milk-supply. The subject is considered under five headings, of which the following is a brief résumé: 1. Sour milk or milk on the point of souring is liable to produce gastric and intestinal catarrh. The causes of souring are lack of cleanliness and high temperature. 2. Milk may be unfit for use because the animals are improperly fed or are being treated with various remedial agents which may be excreted in the milk. 3. Milk may be the product of a diseased animal. Local diseases of the udder which cause pseudodiphtheria, as well as general diseases, may be conveyed to the consumer. 4. Tuberculosis, he believes, may be contracted from milk. 5. Milk may acquire specific infective properties after it leaves the animal. Many epidemics of typhoid, scarlet fever, and diphtheria have been caused in this manner. Of the 330 epidemics analyzed 243 were recorded by English authors, 52 by American, 14 by German, 11 by Scandinavian, and 5 each by French and Australian.

¹ American Journal of the Medical Sciences, May, 1901.

It is interesting to note that the English and Americans usually consume raw milk, while on the Continent milk is rarely used without being boiled.

DISEASES OF THE ALIMENTARY TRACT.

Preservation of the Teeth. During the years of growth the condition of the teeth is of great importance. By preventing proper mastication imperfect teeth may interfere materially with the nutrition of the child and impair his future well-being. The following excellent rules¹ are recommended by the School Children's Committee of the British Dental Association: Without sound teeth there cannot be good mastication. Without proper mastication there cannot be perfect digestion. Clean teeth do not decay. The importance of a sound first set of teeth is as great to the child as a sound second set is to the adult. Food left on the teeth ferments, and the acid formed produces decay.

The substance of the following rules should, therefore, be constantly impressed upon all children: 1. The teeth should be cleansed at least once daily. 2. The best time to clean the teeth is after the last meal. 3. A small toothbrush with stiff bristles should be used. 4. A simple tooth-powder or a little soap and some precipitated chalk taken up on the brush may be used. 5. It is good practice to rinse the mouth after every meal. 6. All rough usage of the teeth, such as cracking nuts, biting thread, etc., should be avoided. 7. When decay occurs it should be attended to before pain results.

Retropharyngeal Abscess and Adenitis. While these conditions occasionally occur, they are not frequent. Adenitis without suppuration is particularly rare. Henoeh, in his vast experience of fifty years, saw but sixty cases. Snow² reports one case of retropharyngeal adenitis and two of abscess. He says that the symptoms are easily misunderstood; the patient is commonly treated for a pharyngitis or croup. Usually it is noticed that the little patient has difficulty in swallowing. It will attempt to nurse, but will quickly drop the nipple or bottle, and cry. Modifications of the voice are frequent. If the abscess is in the upper portion of the pharynx the cry is nasal, the breathing is snoring and snuffling in character, and the child sleeps with its mouth open. If deep in the pharynx, level with the epiglottis or larynx, there will be hoarseness, stertorous breathing, and attacks of choking or cyanosis, indicating laryngeal spasm or stenosis. The tumor, if large and low down, may press aside the larynx or compress the trachea. Many

¹ Circular of the British Dental Association, 1901.

² Archives of Pediatrics, January, 1901.

sudden deaths are recorded from obstruction of the air-passages or disturbance of the vagus. The younger the child the more distressing are the symptoms of obstruction. All symptoms are aggravated in the recumbent position. Usually the neck is swollen, the cervical lymph nodes being enlarged, especially at the angle of the jaw, often with fever and constitutional disturbance. Older children hold the head stiffly, inclined sometimes to the unaffected side. The abscess is commonly found at the side of the pharynx, behind or below the tonsil, less commonly in the median line. If the swelling is in the superior portion of the pharynx it can be readily seen by depressing the tongue. One sees a local tumefaction bulging forward and pushing out the tonsils, sometimes occupying all of the pharynx in sight.

Relief is readily effected by incising the abscess. Bokai's mortality was only 4.5 per cent. (fourteen deaths in 317 cases), but allowance must be made for the great skill and experience of the operator. On account of the tender age of the patient, the extreme narrowness of the fauces, and the unusually deep location of the abscess, the operation is difficult, and a cautious prognosis should be given. Retropharyngeal abscess is one of the grave affections of infancy. The ultimate mortality is very great. Death may take place from asphyxia, pressure on the vagus, spontaneous rupture of the abscess, or from accidents of the operation. Incision of the abscess through the mouth is advocated by Bokai. He first draws off a portion of the pus with an aspirating needle, and afterward enlarges the opening with a bistoury, pressing out the contents from below with the finger. After the abscess is opened the child is tipped forward to allow the pus to flow out of the mouth. Holt opens the abscess with a sharpened finger-nail. Other surgeons prefer the method of Hilton and Burkhardt, who evacuate the abscess through an external incision along the border of the sternocleidomastoid muscle.

Hypertrophic Pyloric Stenosis. This subject was reviewed at considerable length last year. Several cases have been reported since that writing. The most notable papers are those of Cautley¹ and Southworth.² Cautley says that at the time of his writing twenty-six cases had been recorded. The two theories as to causation—a simple redundancy of foetal growth and a functional disorder of the nerves of the stomach leading to ill-co-ordinated action of the muscle—are not regarded as satisfactory. Pylorotomy offers the best chance for success. Now that more attention has been attracted to the subject, it is probable that an earlier diagnosis and better results will be attained.

In Southworth's case the diagnosis was made for the following

¹ Lancet, October 6, 1900.

² Archives of Pediatrics, January, 1901.

reasons : 1. The early occurrence and persistence of vomiting, uninfluenced by the usual measures for its relief. 2. The absence of any vestige of milk residue in the stools until the ninth day, while the presence of green mucous stools excluded obstruction below the duodenum. 3. Perfect digestion of the milk residue when it appeared in small quantities in the stools, despite the continuance of the vomiting, which seemed to preclude the possibility that the vomiting was due to indigestion. 4. The absence of any symptom on the part of the mother which might cause her milk to disagree with the baby ; maternal anxiety was not awakened until long after the inception of the vomiting. Two years before she had successfully nursed her first child. 5. The abrupt cessation of the vomiting, which pointed to a sudden relief of the cause. A careful examination of the literature compels the suspicion that both the macroscopical and microscopical appearances of the thickened and contracted pylori, together with the increased thickness of the muscular layers and their individual muscle fibres, are chiefly due to the marked tonic spasm of this portion of the intestinal tube. This is in accord with the views of Pfaunder and Romme.

Ulcer of the Stomach. This is very rare in young children. Parkinson,¹ however, reports its occurrence in a child aged two years and two months. It had suffered for ten days from slight fever, occasional vomiting, and gastric symptoms, when it suddenly vomited blood and collapsed, with typical symptoms of acute peritonitis. At the post-mortem examination there was found near the centre of the posterior wall of the stomach a punched-out ulcer with thickened edges, and a perforation a little larger than a pin's head at its base. A second ulcer was to be seen in the posterior wall of the stomach near the one described. Mackey² reports a case of perforative gastric ulcer in a girl, aged seventeen years. Operation was performed four hours after perforation, and the girl recovered.

Ulcer of the Duodenum. This is also of rare occurrence in infancy, but a case is reported by Adriance³ in an infant, aged ten months. At the autopsy a small oval ulcer was found just below the pylorus. It was situated on the posterior wall of the duodenum, its base being formed by the head of the pancreas, to which it was firmly adherent. The margins were sharply cut, showing no induration. The rest of the duodenum as well as the neighboring bloodvessels appeared normal.

Occlusion of the Duodenum. Congenital occlusion of the small intestine is said to occur most often in the duodenum. In an extended

¹ Archives of Pediatrics, June, 1901.

² Lancet, February 16, 1901.

³ Ibid., April, 1901.

article on the subject Louise Cordes¹ reports a case and presents in tabular form the history of the 56 other cases recorded in the literature. The causes which may lead to intestinal occlusion are numerous, some of the most important being : (1) Errors of development, (2) volvulus, (3) foetal peritonitis, (4) ulceration, (5) pressure caused by new growths, (6) abnormally long persistence of the omphalomesenteric duct, (7) traction due to inguinal hernia, (8) circulatory anomalies, and (9) embolism of the superior mesenteric artery. Grouping these cases, we find that females numbered 13, males 14, sex not stated in 30 ; 16 were premature infants. In cases of total occlusion the duration of life varied from thirty hours to nine days ; in the cases of stenosis from thirty hours to six months. The majority of the infants died on the third, fourth, and fifth days. Vomiting was noted in 41 cases ; not mentioned in 16 ; like meconium in 14 ; watery, brown, or yellowish material in 5 ; black or coffee-ground or blood in 8 ; nourishment in 2 ; no mucus or bile in 2.

Colic. In a paper on this subject Illoyay² says that flatulence excites colic only when the distention of the bowel is moderate. The causes of infantile colic are flatulence, influences acting through the mother, indigestion, and refrigeration. If the mother is constipated the infant is apt to be afflicted in the same way ; moreover, the milk of the constipated woman is apt to cause flatulence. Indiscretions in the mother's diet and the use of such purgatives as salts and senna are common causes of colic in the nursing infant. Mental worry and sexual excitement also deleteriously affect the mother's milk. The commonest causes of colic in the infant are overfeeding, too frequent feeding, and the use of food of improper quality. Occasionally colic arises from a deficiency of food. Refrigeration is another important factor, and arises commonly from allowing the infant to walk or sit on a wet floor, lie in a wet diaper, or remain with the abdomen exposed in a draft of cold air.

TREATMENT. The treatment naturally divides itself into the immediate relief of the pain and the removal of the cause. By the external application of heat and irrigation of the lower bowel with hot water much can be done to relieve the colic. It is inadvisable in protracted cases to resort to opiates, because of the ease with which the little ones become addicted to the use of such drugs. Illoyay especially prizes the freshly prepared milk of *asafœtida*. It should be given in doses of from one-third to one-half a teaspoonful with a little fine sugar on a spoon, and may be repeated in fifteen or twenty minutes if necessary. Warm fennel tea given just before nursing sometimes averts the attack

¹ Archives of Pediatrics, June, 1901.

² Ibid., April, 1901.

of colic. The routine use of alkalies is not to be recommended, as they tend to impair digestion. Hiccough can often be relieved promptly by putting a few grains of fine sugar in the baby's mouth.

The Diarrhœas of Infancy. As the Presidential Address to the American Pediatric Society, Dr. W. D. Booker¹ presented a paper of great interest upon the early history of the summer diarrhœas of infants. Numerous references are contained on this subject in the very earliest medical literature. Dr. Booker traces the history of this disease from the middle of the eighteenth century, explaining the various theories held regarding it, and showing the gradual development of knowledge up to the present time. It is difficult to give a satisfactory résumé of such a paper in a short space. A careful reading will prove not only of interest but profit to the physician who has these diseases to deal with.

The bacteriology of summer diarrhœas continues to be the subject of much earnest study. Among the observers who have contributed most valuable material is Escherich.² He holds that it is reasonable to assume from known facts that the presence of bacteria different from those commonly found in the intestine may be the cause of disease. The products of bacteria formed outside of the body may also cause serious symptoms. Escherich believes that the normal intestinal flora is greater than has yet been taught. Under normal conditions it is independent, in large measure, of the bacteria introduced with the food. Small disturbances in the chemistry of the intestine and of the general health affect the bacterial flora very markedly. It may be assumed that the introduction and multiplication of any micro-organism not common to the normal flora may induce morbid changes. As yet there exists no satisfactory classification of the gastro-intestinal diseases of infancy. From a bacterial stand-point three classes of infection are recognized—intoxications through decomposition, infection of the chyme, and infection of the intestine. The number and kind of bacteria present are important factors in the pathogenesis of these infections. The belief that the death-rate from gastro-intestinal diseases progressively diminishes as age advances is not in accordance with Escherich's experience.

A paper which caused considerable discussion was that of Kerley,³ read before the last meeting of the American Pediatric Society, in which he reported 555 cases of summer diarrhœas among the out-patient poor. Of these children 75 were under three months of age; 87 between three and six months; 150 between six and twelve months;

¹ Archives of Pediatrics, July, 1901.

² Archives de Médecine, vol. iii., No. 12

³ Archives of Pediatrics, August, 1901.

187 between one and two years; 51 over two years. But 20 were fed on proprietary foods, which means that their expense prevents their use among the tenement population; 59 were fed on condensed milk; 1 was fed on goat's milk; 472 were fed on cow's milk, entire or in part. These figures again remind us of the necessity of placing good milk within the reach of the poor. Six per cent. only of all the patients were nursed. Eighty cases recovered in three days; 168 in from four to seven days; 79 in from seven to twelve days; 62 from twelve to seventeen days; 58 during the fourth and fifth week; 11 during the sixth and seventh week; 6 from the eighth to the tenth week; 15 from the third to the fifth month. Of the 499 treated to a conclusion of the illness 10 died, the death-rate being a little over 2 per cent.

A study of the functional changes in the liver and kidneys in the course of gastro-enteritis in infancy is reported by Leslé and Merklen.¹ They do not find any specific changes, but there may be an epithelial degeneration or sclerosis, or simply congestion, according to the duration of the disease. Indicanuria, though common, is not constant. Glycosuria sometimes occurs in the chronic, but not in the acute forms, and is due to insufficient liver action. The excretion of urea is diminished in every form of the disease. The quantity of urine is diminished in the severer cases; the acidity and specific gravity are increased.

TREATMENT. The stopping of milk diet is universally advocated by all writers. Kerley,² for example, stops it as an invariable rule of treatment, regardless of the severity or duration of the illness, regardless of the diet, whether breast-fed or bottle-fed, whether the stools are frequent and watery or infrequent and foul. This is based upon the belief that in every case of summer diarrhoea, no matter how mild, we have an infection or soon will have it, and we wish to make the intestinal contents as poor a culture field as possible. As a substitute for milk he commonly employs dextrinized gruel, because more concentrated nourishment may thus be given. He uses also broths and frequently a combination of broth and cereal water, a favorite mixture being four ounces of barley water and one or two ounces of beef, mutton, or chicken broth. Two tablespoonfuls of beef-juice may be added to the cereal water. He does not use egg-water mixture or alcoholic stimulants. Among drugs he uses castor oil or calomel to clear the bowels, and bismuth in full doses, at least 10 grains every one or two hours. Bismuth he considers a remedy of immense value. In order to be of service, however, it must produce black stools. In other words, if some of it is not converted into sulphide of bismuth in the

¹ *Revue Mens. des Malad. de l'Enf.*, February, 1901.

² *Loc. cit.*

intestine it is without value. The indications for the use of opium are pain, tenesmus, and frequent stools. It was used in 200 of the 555 cases. He speaks against overfrequent irrigation of the colon, and disproves it entirely in cases having large, frequent, watery discharges.

In the discussion upon this paper¹ most of the methods of treatment proposed were approved. Upon a few points there were differences of opinion. Griffith has found by extensive observation that nothing could be accomplished unless the milk diet is stopped. He believes there are cases in which too active peristalsis is a threatening factor, which should be stopped promptly by opium. This does not mean that it should be used in the majority of cases. Irrigation, valuable in some cases, has been sometimes overdone. He regards egg-water and alcohol as useful agents. Koplik also uses them, but he rarely uses opium. Buckingham uses brandy in many cases. Holt warned against overactivity in treatment, as rest is an important factor. He frequently uses sulphate of magnesia as the initial cathartic. Northrup uses castor oil freely, often administering it after the calomel. Calomel plus castor oil, gum-arabic water, starvation diet, rest, and plenty of water are the points he would especially emphasize. Freeman relies largely upon bismuth. Winters stops milk at once. He uses calomel and oil, and also opium in a limited number of cases, and irrigation in selected cases. He disapproves of alcohol, but uses bismuth largely. Adams stops milk promptly and relies largely on rest. He does not use bismuth extensively. Cotton uses egg-water and employs irrigation more freely than some authorities. It is given at first to cleanse the colon, and later to stimulate peristalsis to bring down into the colon the decomposing material. There is another rectal irrigation that means something entirely different. The moribund child with a weak heart needs irrigation in order to fill the vessels with fluid, and normal salt solution injected into the colon will stimulate such a heart. He believes that of all of these the most valuable is washing out of the colon. Morse uses egg-water. He does not use stimulation in most cases, but in some he regards it as very necessary. Dorning believes much in the value of fresh air, and also regards rest as an important factor. Rotch believes in the use of alcohol in cases needing stimulation, but thinks that albumin water is frequently given in too high percentages. He believes that too much calomel is given. Irrigation is valuable at the beginning and at times during the course of the disease. Saunders uses alcohol, but does not use egg-water in children under two or three months old.

It will be seen from these expressions of opinion by some of the

¹ Archives of Pediatrics, August, 1901.

leading authorities of this country that while there are differences regarding minor details of treatment, there are practically no differences upon essentials. The unanimity of opinion is, in fact, rather striking.

In an excellent article on the medicinal treatment of summer diarrhoea, Southworth¹ describes three different types: 1. Diarrhoea caused by inability to digest unsuitable articles of food. 2. Diarrhoea resulting from bacterial action in tainted milk. 3. Cholera infantum, probably also due to milk infection. In the first the prompt evacuation of the undigested food, with proper feeding, will generally relieve the symptoms. The second is generally due to milk infection. Relief depends upon the promptness of the discontinuance of the milk and removal of the residue from the intestines. It is a good rule to stop the milk, including the breast-milk, in any child under two years of age which begins with vomiting or fever. In the severer type in which the stools are frequent, profuse, and watery, where the patient is threatened with collapse, the hypodermic use of morphine, $\frac{1}{100}$ grain for a child aged one year, is advised, with $\frac{1}{800}$ grain of atropine. If there is great loss of fluid, hypodermoclysis should be performed.

The following treatment is advised by Zahorsky:² 1. Take the infant from a milk diet. 2. Administer a purgative. 3. Give some cereal decoction. 4. Prescribe a mild antiseptic mixture which will do no harm to the patient. 5. Treat the dangerous symptoms. 6. Gradually restore a normal diet by adding small quantities of meat broth, whey, or human milk to the cereal mixture. 7. Cow's milk should then be given in very small quantities added to the cereal decoction. 8. The amount of food should be adapted to the power of the digestive apparatus. Hollopeter³ asserts that in the management of the febrile stage of gastro-intestinal disorders of young children the keynote is the cleansing of the gastro-intestinal tract of all bacteria and material that generates bacteria, the administration of sterile food, and absolute quietude. He advocates hydrotherapy and not the use of antipyretic drugs. Bathing children suffering from this condition requires care. After the initial bath at 95° F., lasting for at least five or eight minutes and cooled down until the temperature reaches 90° F., place the child in a comfortable bed, with a light sheet and counterpane, and for the next twenty-four hours let it be as little disturbed as possible.

Blackader⁴ strongly insists upon the immediate stopping of milk and the thorough initial irrigation of the bowel. The administration of drugs plays a secondary part in his treatment. He concurs with the consensus of opinion that the intestinal antiseptics with which we are

¹ Medical News, July 13, 1901.

² St. Louis Medical Review, August 3, 1901.

³ International Medical Magazine, July, 1901.

⁴ Ibid.

at present acquainted give but a modicum of assistance in this disorder, and they have a depressing action on the heart and circulation, which we are especially anxious to avoid. Alcohol as a heart stimulant he regards as of much value. Used in moderate quantities it improves digestion, stimulates absorption, and is to some extent a food. He regards bismuth as of distinct benefit if given in full doses of at least 10 grains every two or three hours. If the movements are very frequent or very watery a small amount of opium may be added in the form of camphorated tincture.

Intestinal Sand. Two cases of this peculiar condition are reported by J. A. Scott.¹ A résumé is also given of the literature, which includes but six or seven articles. La Boullbene, in 1873, first reported a case in which sandy material, which proved to be vegetable matter with silicious particles attached, passed per rectum. Scott's first case was a woman, aged about forty years, who passed gritty material with the stools. Examination showed it to be a light yellow concretion, not unlike coin-dust in appearance. Microscopically it looked like uric acid, but examination by chemical methods showed its absence. The second case was a child, aged three and a half years, for eight months subject to attacks of duodenal and ileac catarrh, with marked toxic symptoms. In the beginning of these attacks, together with undigested curds and mucus, would be found a very firm, gritty, reddish or pinkish sand, which would disappear as the stools approached normal. After maceration in strong acids the sand would gradually soften, with but little effervescence, leaving a gummatous material. Crystals looking like the fatty acids were found.

Intussusception. Edmund Owen² gives the following summary of the symptoms of intussusception: (1) Sudden abdominal pain; (2) vomiting; (3) the passage, with much straining, of a stool containing mucus, blood, and scanty liquid feces; (4) the presence of a tumor in the region of the ascending colon. He believes that medical treatment can afford no trustworthy means of curing this condition, and prompt abdominal section is the only practical and scientific way of affording relief. Clubbe³ reports forty-five laparotomies for intussusception, of which twenty-four recovered and twenty-one died. In the successful cases the time which elapsed from the onset of the symptoms until the operation averaged twenty-four hours, whereas in the fatal cases the average was fifty-six hours. These figures alone show the importance of early diagnosis. He finds injections both useful and safe, and he nearly always uses them at whatever stage he sees a case. Properly given

¹ Archives of Pediatrics, June, 1901.

² British Medical Journal, September 7, 1901.

³ Ibid., March 23, 1901.

they reduce the intussusception to a certain extent and in a very gentle, harmless manner.

Pitts¹ reports 115 cases treated in St. Thomas' Hospital, London. He reserves inflation for acute cases seen in the first few hours. Sometimes inflation is useful as a preliminary, as it limits the field of operation. Water pressure is better and less dangerous than air. It should be introduced through a small funnel, held not more than two feet above the level of the patient. Primary abdominal section is now the rule upon admission to the hospital, and since this rule was adopted the results have been forty-eight cases, with twenty-seven deaths and twenty-one recoveries. In 1897 Pitts published a paper upon this subject. Since that time his experience has led him to modify his conclusions somewhat, so that they now stand as follows: 1. Inflation or injection should be tried only if the case is seen within a very few hours and if the symptoms are not very acute. 2. Inflation may be useful as a preliminary by limiting the field of operation. 3. When resection is necessary it may be followed by reunion of the bowel in chronic cases. In acute cases a wide resection may be carried out at once; an operation for the restoration of the continuity of the bowel at a later period.

D'Arcy Power² reports sixty-five cases, with forty-two deaths and twenty-three recoveries. He advocates immediate operation in all cases at the earliest possible moment. Irrigation may be used to reduce the suffering of the patient until preparations can be made for the operation and also to reduce the size of the tumor. A rare case is reported by Carson,³ in which a descending intussusception was associated with an ascending one, the two occupying the same segment of the bowel. The descending intussusception was of the ileocaecal variety, thus differing somewhat from the description given by Treves.

Appendicitis. A case of this disease is reported by Griffith⁴ as occurring in an infant, aged three months. Operation was performed, but the child did not survive. Appendicitis is not common under the age of five years. At the age of two years or less the affection can certainly be called rare, and the younger the child the less common it appears to be. The author was able to find but 15 recorded cases, of which he gives brief abstracts. Brun in 45 cases in children observed by himself reports 3 from one to five years of age, 20 from five to ten years, and 22 from ten to fifteen years. Fitz in 228 cases of appendicitis at all ages found 22 from twenty months to ten years, and 86 from ten to twenty years. It is interesting to note that in 9 of the 15

¹ *Pediatrics*, September 15, 1901.

² *Ibid.*

³ *Lancet*, October 6, 1900.

⁴ *Archives of Pediatrics*, October, 1901.

cases reported by Griffith the appendix was found to be perforated ; that in 4 cases the appendix had descended into the scrotum ; that 9 cases were operated upon, with 7 recoveries ; that in 2 cases the disease had been diagnosed as intussusception. Blumer and Shaw, of Albany,¹ report an attack of appendicitis in an infant, aged seven weeks. This, I believe, is the youngest case on record except two—those reported by Demme and Goyens, to which I referred last year. The infants in each case were six weeks old. Elder² reports appendicitis in an infant aged seven weeks, with a complicating hernia.

Peritonitis. A case of peritonitis observed in a girl, aged four and a half years, is reported by J. H. Bryant,³ of London. The point of interest lay in the bacteria found. The abdomen was opened. General acute peritonitis was found, and pneumococci were demonstrated in the effusion. At the autopsy there was no pneumonia or pericarditis, but pleurisy and peritonitis were present. Comby and Gadaud⁴ report the cases of three little girls attacked with peritonitis, probably of gonorrhoeal origin, in whom a diagnosis of appendicitis was first made. Brun⁵ has reported fourteen cases of peritonitis of pneumococcal origin in children. He refers to the tendency of peritonitis to become encysted and to affect the subumbilical region. Such cases have a favorable prognosis, especially if operated upon. Pneumococcal peritonitis may assume another form, that of diffuse septic peritonitis. The author reports two such cases in children, aged four and five years. They were operated upon by a right iliac incision, as cases of appendicitis. Both died the next day. At the autopsy false membranes were found in the peritoneum and pleura, but no pneumonia. Cultures from the pus showed a diplococcus, which was inoculated into a mouse. The animal died in twenty-four hours, and the pneumococcus was found in its blood.

Rectal Polypi. In a paper upon the etiology of these growths, Huber⁶ says that he has noticed one feature common to all the cases—they were only found in patients who at the same time showed evidences of lymphoid hypertrophies in the nasopharynx, with other manifestations of the status lymphaticus. This can hardly be a mere coincidence. Such polypi are probably local manifestations of the status lymphaticus. When the follicles are enlarged, constipation, diarrhoea, or some peculiar idiosyncrasy in the patient induces further increase in their size.

¹ Archives of Pediatrics, August, 1901.

² Montreal Medical Journal, vol. xxx., No. 3.

³ Archives of Pediatrics, October, 1901.

⁴ Gazette des Malad. Infant., June 13, 1901 ; Archives of Pediatrics, October, 1901.

⁵ La Presse Médicale, February 27, 1901.

⁶ Archives of Pediatrics, September, 1901.

Intestinal peristalsis and the passage of fecal masses exert a downward traction, gradually forming a pedicle, and not infrequently a tearing away of single growths.

Cyclic Vomiting. Acker¹ reports a case of a girl, aged ten years, who received a kick in the umbilical region which was followed by uncontrollable vomiting for three weeks. Several attacks occurred during the following year. The vomited matter consisted of gastric juice and mucus, and was very profuse. Nausea, thirst, and frontal headache were marked. There was no apparent cause for any of the later attacks, which lasted from five to seven days. The treatment consisted of an ice-bag to the epigastrium, ice in the mouth, nutritive enemata, and stimulation when needed. The temperature ranged from 98.8° F. to 101° F. For the first thirty-six hours in these cases everything should be withheld from the stomach, and the bowels should be cleared with an enema. The prognosis is good, except in very young children, who may die from exhaustion.

DISEASES OF THE RESPIRATORY TRACT.

Adenoid Growths. As compared with the former extensive literature on this subject, that of the past year has been very meagre. One of the best papers is that of Huber.² It contains but little, however, that is not presented in his paper in the Jacobi Festschrift referred to in these pages last year. The most certain method of diagnosis is physical exploration, but the practitioner often hesitates to employ this method. Huber asserts that under such circumstances reliance may be placed upon two symptoms: 1. The presence of two small lymph nodes, painless and freely movable at the angle of the lower jaw, one on either side. Though apt to become swollen with each new catarrhal inflammation of the nose, they return to their former size when the nasal trouble has disappeared, providing a mixed infection has not taken place. 2. Upon oral examination and inspection, if the size of the tonsils does not obstruct the view, numerous small lymphoid hypertrophies will be found upon the mucous membrane of the posterior pharynx; now and then, at the level of the soft palate, larger masses are present. The appearance of diffused lymphoid infiltration is characteristic, the isolated prominences, more or less numerous, pearly and translucent in appearance, resemble smaller or larger sections of boiled sago projecting above the surface of the pharyngeal mucous membrane. Tenacious mucus, which should be removed, may coat the nasopharynx-

¹ American Journal of Obstetrics, vol. xliii., No. 5.

² Archives of Pediatrics, March, 1901.

geal wall and partly obscure these little growths. The presence of the latter or of the glands at the angle of the jaw justified the diagnosis of adenoids.

Some important observations upon adenoids with reference to tuberculosis are reported by Nicoll and Lartigau.¹ Their studies were based upon seventy-five adenoids removed from children who appeared to be otherwise healthy. They cut the specimens in half, and used one-half for inoculation experiments and the other half for microscopical study. These adenoids were tested for tuberculosis. In 10 per cent. of the cases there were present not only tubercle bacilli but the histological lesions of tuberculosis; in 5.3 per cent. the tubercle bacilli were present without other evidence of tuberculosis. It certainly seems very significant that tuberculosis should have been present in 10 per cent. of these cases.

Bronchitis. Our knowledge of the bacteriology of bronchitis is extremely meagre. Jelliffe,² in an editorial article, after reviewing the subject as it now stands, concludes that Ritchie's work is the most important contribution to the bacteriology of bronchitis within recent years. Though not conclusive in all particulars, the results must encourage others to investigate along the same general lines. This work seems to show that bronchitis is always of an infective nature, but is not due to any one specific micro-organism. Several varieties of bacteria are always present, showing that the disease is a mixed infection. It is probable that any one of these bacteria alone may incite to bronchitis. Whether this is always so in the beginning it is difficult to say. It is probable that at the outset one organism is often the primary cause. Among the bacteria commonly present are staphylococci, streptococci, diplococci, pneumococci, influenza and diphtheria bacilli, colon bacilli, and others. Influenza and diphtheria bacilli have been found when the ordinary symptoms of these diseases were not present. The field is certainly an interesting one, and will, no doubt, receive further study in the future.

A paper on the clinical features and treatment of acute bronchitis in children, by O'Donovan,³ contains some excellent advice on treatment. Rest in bed, the oiled-silk jacket, and counter-irritation are given as the chief factors in the management. He does not advise much medication, and in some cases none at all. In fact, the treatment advised is very similar to that for milder cases of pneumonia. He refers particularly to the caution required in giving hypnotics. Bromide of sodium will suffice in many cases, but in some, in which the cough is harassing and

¹ Archives of Pediatrics, August, 1901.

² Medical News, March 2, 1901.

³ Ibid, July 13, 1901.

the nervous system excited, small doses of codeine or heroin are advised. I would particularly commend the advice of the writer to put the children to bed and to employ mild counter-irritation to the chest. It will shorten the attack and vastly lessen the danger of destroying the appetite and disturbing the digestion. Such measures are better from every point of view than loading the stomach with drugs. In the bronchitis of emphysematous children of rhachitic or lithæmic tendency, Saint-Phillippe¹ advises the use of a 1 per cent. solution of iodide of arsenic thrice daily, with meals, in doses ranging from 5 to 10 drops.

Bronchopneumonia. The literature of bronchopneumonia has been more scanty during the past year than for many years before. For several years it was very extensive, treatment receiving particular attention. Protracted influenzal pneumonia in infancy is considered by F. X. Walls.² While infants are not particularly susceptible to influenza, when it does occur it frequently runs into protracted pneumonia. It often begins with gastro-intestinal symptoms, involvement of the respiratory tract occurring later. Cough is at first not troublesome, but later increases in intensity until it is paroxysmal and continuous, and simulates that of pertussis. Breathing is rapid, hurried, and jerky. Involvement of the middle ear, with rupture of the drum, is not infrequent. Consolidation is apt to be slow in development, while signs of bronchitis may be heard over the remainder of the chest. The exanthem simulating the scarlatinal rash, sometimes seen in adults, is rarely seen in very young children. Diagnosis is often difficult; the disease may be often confounded with gastro-intestinal infection, malaria, sepsis, or miliary tuberculosis. There is no specific treatment, but the little patient should be kept quiet and be fed on a nutritious diet suitable to its digestive capacity. Nauseating cough mixtures should be avoided. Stimulation should be given as indicated. Cold applications to the skin frequently act in a happy manner in cases of threatened suffocation.

Pleural Effusions. Carmichael³ reports three cases of pleural effusion, and draws attention to the fact that such effusions are particularly frequent in childhood. They occur in especially large proportion in infants under two years. Pleurisy is rarely a primary disease. It occurs generally as a sequel or accompaniment of pneumonia or of one of the eruptive fevers. It may be associated with tuberculosis of the lungs or abdominal organs. It is a well-known clinical fact that the absorptive power of serous membranes under favorable conditions is almost as great as the effusive.

¹ Journal de Médecine de Bordeaux, March 5, 1901.

² Medical News, July 6, 1901.

³ Archives of Pediatrics, September, 1901.

TREATMENT. Rest in bed during the whole period of absorption is important. We do not attach so much importance now as formerly to free action of the kidneys, but no doubt, along with maintenance of the cutaneous perspiration, it has its effect. In large serous effusion the question of aspiration presents itself. In Carmichael's experience it is only exceptionally necessary. The two main indications for aspiration in serous cases are slow absorption of the fluid or the physical embarrassment on account of its presence, as evidenced by dyspnoeas from interference with the functions of the lungs or other organs. With reference to purulent effusions, they are to be treated on surgical principles, the same as for pus collections in other parts.

Empyema. In a study of this subject, Hartley,¹ of New York, reports 52 cases treated in the Presbyterian Hospital during eight years. One-fifth of the cases were in children under five years of age, and more than half occurred in children before the twentieth year. This fact impresses the importance of keeping in mind the possibility of empyema in children and young adults. In 27 cases the right side was affected; in 22, the left; in 2, both sides; and in 1 the side was not stated. No influence on the course of the disease attaches to the side involved. In studying the bacteria, Hartley does not distinguish between children and adults, so that his figures mean but little. In children the pneumococcus is most frequently found; in adults the streptococcus. In children the number of tuberculous empyemas is barely half that in adults. In the matter of treatment his conclusions accord with those of most authorities, except as regards resection of ribs and irrigation. The latter is not generally employed, unless the discharge shows evidence of decomposition, or there are decided septic conditions. In answer to the question, Why do patients with empyema die? Hartley says that among the 52 cases 12 died; 5 from causes other than the empyema itself, as sarcoma, general pyæmia, and tuberculosis. This leaves 47 cases, with 7 deaths, attributable directly to the empyema, a mortality of 15 per cent. Of these only 2 occurred where prompt treatment was used, the duration of one being four days and the other five days. The remaining 5 deaths were in patients of very low vitality prior to the empyema, or in those in whom the disease was neglected. From these figures it seems that with patients with fair physique prompt surgical interference ought to bring the mortality of empyema well under 10 per cent., and perhaps as low as 5 per cent. This gives us food for reflection when we find the mortality from all statistics given by various authorities varying from 15 to 20 per cent., or even higher. Conclusions derived from the study of these cases are

¹ Medical News, July 13, 1901.

in part as follows : 1. Children are especially liable to empyema following pneumonia. Unless promptly relieved by drainage the prognosis is bad. With such relief the prognosis is good. 2. Pneumonia caused empyema in 50 per cent. of the cases considered, and such cases were of severe type. 3. Tuberculous family history exerts little influence on empyema. 4. In about one-sixth of the cases the empyema was sacculated. 5. Chloroform was the anæsthetic of preference. Deep narcosis is contraindicated. 6. In adults with general empyema two inches of the seventh and eighth or eighth and ninth ribs in the posterior axillary line should be resected. In children the same length of the seventh rib. Simple incision is rarely advisable. 7. Operation is indicated as soon as the diagnosis is made. 8. Irrigation of the abscess cavity with bichloride solution, 1 to 5000, or carbolic acid, 1 to 100, is indicated, unless drainage is perfect and no sepsis is present. In children the solutions may be weaker.

It is alleged by Dunn¹ that tardy diagnosis, inefficient drainage, and slovenly after-treatment are the most frequent causes of failure ; retarded convalescence and deformity, though less frequent than formerly, are not seldom encountered. Treatment is too often undertaken by those unacquainted with surgical methods. Prompt recognition and adequate drainage minimizes rupture into bronchi, systemic infection, loss of lung expansion, and pleural thickening. The degree to which the collapsed lung recovers depends largely upon the length of time the lung has been compressed.

Jacobi² reports a profuse hemorrhage from a pyothorax in a girl, aged seven years. After an ordinary operation there was a profuse flow of blood, and inspection showed that the blood was oozing in quantities from tufts disseminated over the pulmonary pleura. These tufts could easily be distinguished with the fingers. They extended over a large surface and were quite numerous. The lung not expanding readily, the cavity was filled with large quantities of sterile gauze, which was allowed to remain for two days. When it was removed a little fresh blood was seen to ooze from a few granulations. Gauze in smaller quantities was introduced and removed after two more days, when no blood was found. The cavity, which diminished in size, was again filled with gauze for some days, until a drainage-tube could be safely inserted. The pleural surface was then no longer red ; the granulations had shrunk. Search for a malignant tumor had no results, nor was there a suspicion of tuberculosis. There was no adhesion between the two pleuræ, the tearing of which could have given rise to hemorrhage. A good recovery followed. This case is reported by Jacobi as being a cause of hemorrhage not yet recorded.

¹ American Medicine, June 22, 1901.

² Archives of Pediatrics, July, 1901.

DISEASES OF THE CIRCULATORY SYSTEM.

Acquired Heart Disease. In an excellent article on some cardiopathies, Cotton,¹ of Chicago, lays stress upon the following points as important in making a diagnosis of cardiac disease in children : Altered position of apex-beat ; large normal area of cardiac dulness ; change of relations due to rhachitic chest ; accentuated pulmonic second sound normal in infancy ; diagnosis must never be made from murmurs alone ; cedema may be a symptom, but rarely is ; absence of ordinary symptoms no proof of absence of disease ; compensation is readily acquired in infancy ; all tissues and organs adjust themselves to central circulatory disturbances more readily in infancy than in later life ; myocarditis is a very common result of the ordinary infections ; pancarditis is the rule and not the exception in heart disorders of early life. In studying the antecedents of organic heart disease in children, F. A. Packard² reports an analysis of the histories of 75 cases. Of this number 34 had had rheumatism, either alone (16) or with collateral history of measles, whooping-cough, chorea, etc. Measles had been present in 24, whooping-cough in 19, and chorea in 16. Comparison of these statistics with those of a similar number of non-cardiac cases shows that many of the infectious diseases are as common or even more common in the latter, although this does not hold good for chorea, which occurred in but 2 non-cardiacs. It appears that a history of rheumatism and other infections is insufficient to account for all or even for the greater part of these cases of organic heart disease, and that we must, therefore, attribute many cases to colds, various skin affections, diseases of the mucosæ of the throat and nose, and perhaps also to chance infection in connection with bronchitis, nephritis, meningitis, etc.

In speaking upon the subject of the heart murmurs occurring in anæmic children, Wentworth,³ of Boston, said that he had been looking for so-called functional murmurs in babies under three years, and believed that they were very rare ; while Northrup declared that at the New York Foundling Asylum heart murmurs are common among children and infants who have had no organic lesions. Thousands of such cases occur under three years of age ; in fact, an overwhelming proportion of heart murmurs in infants occur in the absence of valvular disease. Looft⁴ reports careful examination made in fifteen young children having anæmia. The area of cardiac dulness was normal, but all had

¹ Pediatrics, May 1, 1901.

² Journal of the American Medical Association, December 2, 1900.

³ Medical News, June 1, 1901.

⁴ Revue Mens. des Malad. de l'Enf., vol. xviii., No. 10.

a systolic murmur, generally soft in character, not transmitted to the axilla or to the back, and for the most part of greatest intensity in the region of the apex, occasionally also in the second or fifth intercostal space. From watching the history of these children he concludes that a diagnosis of organic heart lesion cannot be based upon the presence of a systolic murmur alone. He proposed the name of accidental inorganic murmur for the sounds heard under such circumstances.

Russell¹ reports three cases of malignant endocarditis, one following measles and another typhoid fever. The third terminated in recovery, and the diagnosis, therefore, was made from clinical evidence alone. Hallé² reports the coincidence of rheumatic endocarditis with congenital heart lesion in a boy, aged three years.

TREATMENT. An admirable article on the care of children with mitral lesions is presented by G. M. Swift.³ He divides such cases into three classes: (1) Cases of heart murmurs without cardiac symptoms; (2) cases of heart murmur with cardiac symptoms; (3) cases of pericarditis, acute and chronic. It is the first of these classes alone with which he deals in this paper. If there are indications that the heart is not doing its work properly, if the rheumatic poison is active, or if the nervous system is irritable, it is best to put the child to bed and keep it there until all such conditions are passed. A stay in bed serves to protect the child from making undue effort while there is an active change going on in the endocardium or cardiac muscle. It also serves to cause those about the child to regard it as not well and not demand too much of it. The prolonged quiet enables the heart muscle to regain its tone and enables the nervous system to become more stable. It is surprising how much is accomplished by rest in bed without any medication. There can be no limit set to the duration of the rest in bed; it must be until we can be reasonably sure that the activity of the rheumatic poison has subsided and until the heart has an opportunity to recover itself. Afterward the slightest indication of overwork should mean another period of rest in bed. It will be found that often the rheumatic poison is still active, and even if there are no indications of it it will be wise to administer steadily some one of the salicylates, as salicylate of soda, salicin, salol, or strontium salicylate. Salicin is least irritating to the stomach. This is important, since it is wise to keep up the remedy for weeks or intermittently for months. A formula devised by Solomon Solis Cohen is a most useful one. It contains in each drachm 7.5 grains of sodium salicylate, 7.5 minims of the tincture of chloride of iron, and a little oil of wintergreen. Iron

¹ Medical Record, April 20, 1901.

² Archives de Médecine, vol. iv., No. 5.

³ Archives of Pediatrics, February, 1901.

in some form is very important, and every effort should be made to maintain the nutrition. The appetite is stimulated by tonics and restoratives, for which purpose we use iron, quinine, arsenic, strychnine, and as aids in nutrition cod-liver oil, olive oil, marrow, whiskey, and wine. Meat is an important element in the diet. The question of exercise depends largely upon the supervision which can be exercised over the child. Exercise in the open air is advantageous if it can be moderate and not excessive. As to prognosis, if the child can be watched and somewhat restrained; if it can be kept in bed until the rheumatic poison and the active stages of endocarditis are past, and then permitted abundant out-of-door, mild exercise, with a generous diet, consisting largely of meat, the outlook, so far as long life and usefulness are concerned, is excellent.

As the result of experience in the treatment of about 500 cases of endocarditis, Caton,¹ of Liverpool, advocates the following: Absolute rest in bed for several weeks; the application of a series of small blisters in the region of the first four dorsal nerves in front, followed by poulticing; the internal administration of sodium iodide. To be of service this treatment must be commenced within the first fortnight or so. In the treatment of heart disease in children, Abt² believes that the salicylates should be used thoroughly and early. They limit the rheumatic process, and may possibly arrest its progress before it has seriously injured the cardiac structure. Alkalies alone or combined are also useful. Counter-irritation in the form of mustard paste or tincture of iodium gives relief at times. To quiet the heart, small doses of aconite are used sometimes, but this is contraindicated if there are any signs of collapse or cyanosis. When a large pericardial effusion is present, aspiration should be resorted to. Rest in bed for weeks and perhaps months is of paramount importance. J. M. Taylor³ presents an extended paper upon the treatment of chronic heart disease in children by systematic movements, but it is impossible to describe them satisfactorily in limited space.

Congenital Heart Disease. Several unusual forms of congenital malformations have been reported, but it cannot be said that much has been added to aid us in the diagnosis of these cases. Cotton⁴ reports three cases and presents a short paper on the subject. Hektoen⁵ gives an extended report of a case of a large defect in the septum between the pulmonary arteries and the aorta, the heart being normally developed. The defect is rare, only nine other cases having been reported.

¹ Archives of Pediatrics, October, 1901.

² St. Louis Medical Review, July 15, 1901.

³ American Medicine, May 25, 1901.

⁴ Pediatrics, May 1, 1901.

⁵ American Journal of the Medical Sciences, February, 1901.

He reports another case of regurgitation through a smooth depression under the base of the anterior aortic valve, with hypertrophy of the heart and dilated arterial duct. No other case of this character is on record. Thomson,¹ of Edinburgh, reports an apparent recovery from a congenital defect of the heart which he believed to be a patent ductus arteriosus. Kissel² reports the rare case of what he believed to be stenosis of the pulmonary artery, with a large opening in the ventricular septum. J. L. Morse³ reports at considerable length thirty-two cases of congenital heart disease upon which he has kept careful notes. The points brought out by the study of these cases, which seem to be of most interest, are : 1. The considerable proportion of cases in which the cardiac lesion was discovered during a routine physical examination, there having been no symptoms referable to the heart. 2. The length of time which the condition may exist without the development of any symptoms referable to the heart, several cases having shown no symptoms at three and four years of age. 3. The comparative mildness of the symptoms in cases of patent foramen ovale. 4. The recovery from lesions which, from physical examination, were apparently the same as those in cases which resulted in chronic invalidism or death.

Arterio-sclerosis. This is an extremely rare condition in early life. A case is reported, however, by Baines,⁴ of Toronto, the patient being a boy aged ten years and six months. He says the only cases he has been able to find are seven collected by Holt and those of Brill and Libman.

DISEASES OF THE URINARY SYSTEM.

Pyelonephritis. A case of this character is reported by Fischer.⁵ In studying this case, as well as those reported by Baginsky, it would seem that the disease is characterized by the following symptoms : Severe gastrodyspeptic symptoms, such as anorexia and vomiting, pain in the region of the kidneys, and constipation. In Baginsky's cases there was the shedding of large pieces of membrane mingled with hardened fecal masses. Variability of the urine is common. It may change from a perfectly healthy specimen to one containing large quantities of albumin, pus, morphotic elements, and mucous. Fever, intermittent in character, with chills and general malaise, is of frequent occurrence. The urine, according to Baginsky, shows the presence of the bacterium coli in pure culture.

¹ Archives of Pediatrics, March, 1901.

² Archives of Pediatrics, October, 1901.

³ Ibid., January, 1901.

⁴ Die med. Wochenschrift, No. 16.

⁵ Ibid., August, 1901.

Perinephritic Abscess. This is a rare condition in children, but Halle¹ reports a case in a girl, aged eight years. She had received a blow in the right lumbar region two months before. The pain persisted and gradually grew worse, so as to interfere with walking. A swelling appeared, and upon puncture greenish pus was found, from which pure cultures of *staphylococcus pyogenes aureus* were found. At the operation the abscess proved to be retrorenal, and had no connection with the vertebral column or other bones. Recovery was complete.

Floating Kidney. This is also a rare condition in children, but is by no means unknown. Five cases are reported by Abt,² the ages ranging from five to fourteen years. Comby has reported eighteen cases in children varying in age from one month to ten years. Traumatism is undoubtedly a cause in some cases, but some are of congenital origin. In children, as in adults, the symptoms are often obscure. Pain may be paroxysmal, dependent probably on a twisting of the pedicle; it may also be colicky in character, and accompanied with a chill, fever, vomiting, and perspiration. The kidney is usually sensitive, but not acutely painful to pressure. Gastro-intestinal symptoms are not uncommon. The right kidney is most frequently affected.

Nephritis. Disturbed action of the kidneys is not uncommon in children. While the appearance of albumin in the urine is not always a sign of organic disease, it should always be looked upon as a symptom of grave importance. Rathmell³ considers that diseases of the kidney in infancy and childhood are chiefly hyperæmias and nephritis following the contagious diseases, especially scarlet fever. Physiological albuminuria may occur at any period of infancy or childhood. It is most common between the ages of five and fifteen years, and rarely persists. Albumin is found in the urine after a rich meal, heavy muscular exertion, intense emotion, and cold bathing. Even when every other constituent of the urine is normal, and functional albuminuria can be differentiated, these cases require the most careful consideration; for, sooner or later—it may be after months or years have passed—grave lesions may show themselves, and we wake up to the fact that insidious degeneration has been going on in the meantime. It is very important, therefore, to decide whether the albuminuria was simply functional or due to organic change. In acute nephritis the amount of albumin depends upon the extent of involvement of the glomeruli, and the amount of casts depends upon the extent of tubules affected.

A case of congenital acute nephritis is reported by Henry Ashby.⁴ The infant was stated to have shown signs of dropsy the second day

¹ Archives of Pediatrics, April, 1901.

² Journal of the American Medical Association, April 27, 1901.

³ American Medicine, June 22, 1901.

⁴ Archives of Pediatrics, May, 1901.

after birth, to have vomited, and to have passed but little water. When examined, at the age of four weeks, there was excessive œdema of the face, trunk, and limbs. The bladder was empty and no urine was obtained. The child died in uræmic convulsions a few hours after it was first seen. At the post-mortem examination the kidneys were found to be lobulated, and upon section they were pale, resembling the appearance of the "large white kidney." Guthrie¹ reports a case of chronic interstitial nephritis in a girl, aged seven years. This form of kidney disease is particularly rare in children, and Guthrie could find reference to but eight similar cases in the literature. The child might have had an acute nephritis in infancy, or perhaps inherited syphilis was responsible for the mischief. In the discussion Sansom remarked that in every recorded case of interstitial nephritis in children, intracranial hemorrhage had resulted. He would base his diagnosis in these cases upon the cardiovascular symptoms to the disregard of the renal phenomena. A boy, aged nine years, who had been admitted and readmitted to the hospital at various times, suffering from paroxysmal hæmaturia and albuminuria, with attacks of renal colic, was recently exhibited by D'Arcy Power.² So long as he remained in the hospital he improved, but he soon became worse on his return to school. Exploration was made of the right kidney by the lumbar route, in the hope of finding a stone. A thorough examination, with the passage of a probe the whole length of the ureter, failed to reveal any obstruction. The wound united by first intention. He was on the point of being discharged from the hospital when his gums became spongy, and he showed other evidences of scurvy. This condition yielded to ordinary remedies, and he has had no recurrence of any renal symptoms.

Uricæmia. Under this name Comby³ describes the disturbances caused by the uric-acid diathesis in early and later childhood. Hereditary taint is present in the majority of cases, and alimentary hygiene plays a great part in the production of acquired uricæmia. Boys are more often affected than girls, later childhood than early infancy, and the wealthy more than the poor. The nervous symptoms are cephalalgia, ostealgia, arthralgia, eclampsia, insomnia, night-terrors, neurasthenia, and pseudomeningitis. The digestive system is affected, and vomiting, colic, diarrhœa, constipation, or mucomembranous enteritis may occur. Urinary disturbances, like lithiasis, albuminuria, glycosuria, hæmaturia, vesical spasm, or incontinence appear. The respiratory system may participate, and tachycardia or hypertrophy prove that the circulatory system is involved. Uricæmic fever is of the intermittent, quotidian

¹ *Lancet*, February 2, 1901.

² *Archives of Pediatrics*, October, 1901.

³ *Archives de Médecine*, vol. iv., No. 1; *Archives of Pediatrics*, April, 1901.

type. The prognosis is not grave, but sooner or later arthritic manifestations appear. Both prophylaxis and treatment are based upon alimentary hygiene (especially diet and the drinking of water), care of the skin, and the avoidance of a sedentary life and excessive mental stimulation. Alkalies, lithia, nux vomica, and laxatives are the drugs which prove useful. The acute attacks require absolute rest, diet, and the injection of artificial serum in grave cases.

Enuresis. In an article upon the cure of this annoying condition, Barbour¹ says that the great frequency of enuresis and the absence of any determinable cause in most cases lead to the inference that the most frequent cause has not been ascertained, and especially that it is not a neurosis only. The inefficiency of the usual treatment in ameliorating this condition has led many to strive in an empiric way to secure some more brilliant and certain results than have been obtained under any of the drugs which have been advocated for it. In his own experience, belladonna has been the most effective drug, while the combination of belladonna and salol is still more effective. He does not, however, mention the dose used or the method of administration. Thiemich² does not agree with the commonly accepted theory that enuresis is due to local causes. He believes it to be due to some general nerve condition, for most children suffering from it are children of neurotic parents. Other nervous disorders are frequently present. Epidemics are very frequent in institutions in which many children are brought into close contact. Relief may sometimes be affected by means of suggestion or by electric treatment or change of air. Medicinal treatment has little effect on it.

DISEASES OF THE NERVOUS SYSTEM.

Night-terrors. Of the various neuroses of childhood, night-terrors, while usually of not serious import, are always distressing to both patient and parent. Whatever the exciting cause may be, there always seems to be an underlying neurotic element. Rey³ believes that the condition is always due to some obstruction to the respiration; it may be direct or reflex. The symptoms, he believes, are the result merely of a slow and prolonged carbonic-acid intoxication. Since all night-terrors are symptomatic, it is useless to classify them as idiopathic and symptomatic. If two varieties are absolutely desired, one may separate those due to a direct obstruction to respiration from those due to a reflex cause.

¹ Therapeutic Gazette, September 15, 1901.

² Berliner klin. Wochenschrift, July 30, 1901.

³ Revue Mens. des Malad. de l'Enf., vol. xix., No. 5.

Head-shaking. Several cases of this peculiar condition have recently been reported. It is a functional neurosis of co-ordination, almost invariably terminating in recovery. The two principal symptoms are head-shaking and nystagmus. The affection is observed especially during the first year of life, in the breast-fed as well as in the bottle-fed child. Sometimes the movement is rotary, at other times nodding in character, and both forms may be present in the same patient at different times. Eshner¹ reports two well-marked cases and quotes from the literature. Thomson,² of Edinburgh, who has written upon the subject heretofore, calls attention to the fact that in cases of spasm nutans the nystagmus, when bilateral and horizontal, is usually convergent. In the rotary nystagmus of head-shaking the eye movements are more of the nature of circumduction than pure rotation of the blood around the antero-posterior axis. Nystagmus in this disorder is often unilateral, vertical, or rotary, instead of horizontal and bilateral, as is the ordinary type. It is at times different in the two eyes. Recovery is invariable in a certain number of months. Miller,³ of Philadelphia, reports a case in a child, aged fourteen months, which had continued for seven months. The movements were sixty a minute, and were mostly lateral, interrupted by occasional nodding movements. They were remarkably smooth and rhythmical in character and not at all spasmodic, a peculiarity insisted upon by Aldrich. The movements ceased during sleep, when the attention was fixed, and almost, but not entirely, in the recumbent position. Under ordinary observation no nystagmus could be discovered, but on holding the child's head, and thus stopping its movements, a fine horizontal nystagmus became at once apparent, most marked in the right eye, especially when the gaze was directed upward. No evidence of eye-strain could be elicited. Miller has before reported three cases of this character. In none of them did eye-strain seem to be a possible factor. Jopson⁴ reports a case of head-nodding and nystagmus associated with spasmodic torticollis in a child, aged eleven months. The movements of the head were almost wholly of a to-and-fro or "mandarin doll" type, decreasing or stopping when the infant's attention was arrested, but soon being resumed.

Chorea. While there appears to be some evidence that chorea is an infectious disease involving the motor cells of the cerebral cortex, Eshner⁵ believes that it cannot be separated from the neuroses. The choreiform attacks which follow gross lesions of the cortex do not cause true chorea. Habit chorea occurs in neurotic cases, but without

¹ Archives of Pediatrics, August, 1901.

² British Medical Journal, March 30, 1901.

³ Archives of Pediatrics, March, 1901.

⁴ Ibid., April, 1901.

⁵ Ibid., February, 1901.

any systemic affection. Senile chorea is due to degenerative changes of the brain. Choreia major, so called, is held to be an hysterical phenomenon, and since the association of chorea and hysteria has been noted in certain cases, it is well to look for the stigmata of hysteria in any questionable case. Eshner¹ has also studied the knee-jerks in chorea. As a phenomenon which is common, although not of universal occurrence in chorea, a peculiar modification of the knee-jerks has been cited. To obtain this the patient is placed on the back, with the knee raised and the heel resting on the couch, the muscles of the extremities being thereby in relaxation. If the patellar tendon is now struck the foot rises; but in the place of dropping back immediately it remains suspended for a brief interval, then gradually sinking to the level of the bed. Several variations have been noted. Thus in some cases the interval of suspension has been absent, quick ascent of the foot being followed by a sluggish descent. Sometimes the inhibitory act is not manifest until the foot has begun its descent.

Lumbar puncture has been performed in three cases of chorea by Fornaca.² The first patient was a girl, aged thirteen years, in whom the disease came on with acute symptoms and without fever. The puncture was made on the fifth day of the malady. The second patient was a girl, aged ten years, in whom the chorea appeared to be due to a suppurative otitis media which terminated in perforation. Two lumbar punctures were made in this case, the second of which followed the development of a lesion of the mouth, with purulent infection and fever. In this case the cerebro-spinal fluid was sterile. The third case was a girl, aged thirteen, ill with erysipelas, accompanied by high fever. Upon the onset of chorea, lumbar puncture was performed and was followed by a defervescence, while the choreic symptoms disappeared a few days later. In this case the streptococcus pyogenes was cultivated from the cerebro-spinal fluid.

Tetany. Two varieties of tetany have been described. In the first there are intermittent tonic contractions of the muscles of the extremities; in the second there is spasm of the flexors of the extremities of a persistent, not intermittent, type. Hochsinger³ holds, however, that the latter condition is not true tetany. In this belief he is supported by Hensch and Strümpell. In this condition there is no excitability upon mechanical or electrical stimulation, as in acute tetany. The spasms are, moreover, painless, while in tetany they are usually painful. Tetany is a disease of rachitic children. This second condition the

¹ Philadelphia Medical Journal, June 8, 1901

² La Riforma Medica, Anno xvii., No. 6; Archives of Pediatrics, August, 1901.

³ Wiener med. Wochenschrift, Nos. 7 to 12, 1901.

author calls myotonia. It is most frequently the result of gastro-intestinal disease. An experimental inquiry into the pathology of gastric tetany has been made by Halliburton and McKendrick.¹ They found a toxic substance existing in the stomach which they believe to be the cause of the disease. They have not determined what this substance is, but it is acid in reaction and is soluble in normal saline solution and alcohol.

Convulsions. In a study of 7180 case-records in the Children's Hospital of Boston, Bullard and Townsend² found seventy-three cases of convulsions. A study of these cases led them to the following conclusions: 1 per cent. of the children applying for treatment came for convulsions; 10 per cent. of children between the ages of five and ten years gave a history of convulsions. Cases that appear to be due to some reflex manifest cause may turn out to be true epilepsy. Cases where the attacks occur frequently and without apparent cause may suddenly recover, at least for a considerable period. Children who have had convulsions may be strong and free from nervous tendencies in later life, although the proportion who have nervous tendencies seems to be greater than those who have not had convulsions.

Cerebro-spinal Meningitis. Koplik³ reports *in extenso* five cases of cerebro-spinal meningitis treated by repeated lumbar puncture. Fifteen punctures were made between the fifth and thirty-seventh day of the disease. Four of the patients recovered. The indications recognized as warranting the puncture were continuous headache accompanied by somnolence and delirium, chills, sharp rise of temperature, increase in opisthotonos, increase of coma. If improvement followed puncture, the operation was repeated if the indications reappeared; if improvement appeared to be permanent no further puncture was made. The effects of puncture were various. The pressure relieved was in some cases extreme. In one case delirium furnished the indication, and was relieved by puncture; eleven days later the indication reappeared, but the operation gave no relief until repeated a second time, and not then until the day following. He concludes that relief seems to be more in a diminution of pain and a reduction of those symptoms which may be fairly traced to toxæmia and mechanical pressure. At the same time it seems possible that the withdrawal of an appreciable amount of fluid from the spinal column which contains bacteria and the toxic products of inflammation must be beneficial in the long run on the course of the disease. It is premature at the present day to say to what extent

¹ British Medical Journal, June 29, 1901.

² Boston Medical and Surgical Journal, March 7, 1901.

³ Medical News, March 23, 1901.

the prognosis is influenced by this procedure. It is, however, a method which is certain, Koplik believes, to come more and more into vogue and take its place with aspiration of the pleural cavity as a curative method.

Hunter¹ made a bacteriological study in nine cases of cerebro-spinal meningitis. Fluid was obtained by lumbar puncture in eight cases. The ages of the patients ranged between one month and seven years. A diplococcus was isolated in every case morphologically and biologically identical with Weichselbaum's diplococcus intracellularis meningitidis. In three cases the diplococcus was present in pure culture. The influenza bacillus was associated with it three times, the tubercle bacillus once, and staphylococci twice. The clinical and pathological picture in these cases was of posterior basal meningitis, which is probably a sporadic manifestation of cerebro-spinal meningitis, and is produced by the same micro-organism, namely, the diplococcus intracellularis meningitidis. Langer² reports a case of cerebro-spinal meningitis in a boy, aged nine years, due to the influenza bacillus.

Hydrocephalus. Two cases of hydrocephalus were treated by Ewart and Dickinson³ by withdrawing the fluid and introducing aseptic air. The following provisional conclusions are drawn: With due precautions the fluid of hydrocephalus may be completely evacuated from the yet unclosed skull of infants, and aseptic air allowed to take its place. In favorable cases of moderate effusion a single operation may suffice; oozing from the puncture for a few days after the removal of the tube is not unfavorable. In case of a considerable effusion an obvious indication is to relieve the brain from the weight and pressure of the fluid. By a timely repetition of the operation a hydrocephalic infant may be enabled to carry the weight of the head, and if the treatment is begun sufficiently early, permanent damage to the brain tissue may perhaps be averted. Neuman⁴ reports the case of an infant, aged five months, with marked hydrocephalus. The case being a syphilitic one, large doses of potassium iodide were given. Improvement began after a few days, and complete recovery followed.

Spinal Analgesia. Subarachnoid injection has recently attracted much attention, but most operators have used this operation in adults only. Bainbridge⁵ reports in detail twelve operations on patients from four to six and a half years of age, and over forty on those under fifteen years of age. From the evidence presented it seems fair to conclude that children of all ages stand this method exceedingly well. They may

¹ Lancet, June 1, 1901.

² Jahrbuch f. Kinderheilkunde, January 8, 1901.

³ British Medical Journal, September 7, 1901.

⁴ Deutsch. med. Wochenschrift, January 17, 1901.

⁵ Archives of Pediatrics, July, 1901.

cry out before or during the injection, but soon quiet down, and usually remain calm during the operation. A short bevelled needle having a steel point, the remainder of the needle down to the shank constructed of soft metal, was used, to avoid possible danger of breaking should the patient struggle. Although large doses of cocaine were used in some cases, in only one did any alarming symptoms occur. Usually increase in the drug resulted in a more satisfactory analgesia and fewer after-effects. The first case is interesting as being the second instance on record of general analgesia.

Suicide in Children. In an editorial article¹ the statement is made that suicide is continually increasing among the children of civilized nations. A hundred years ago it was an almost unheard-of occurrence for a child to kill itself. Now, while suicides are commonly reported among the children of France, England, Italy, Switzerland, and the United States, Germany heads the list in point of numbers. In Prussia alone, from 1869 to 1898, 73 boys and 20 girls under the age of ten years and 1173 boys and 342 girls between ten and fifteen years of age committed suicide. The younger children in many cases were totally ignorant of what they were doing. Of the causes for the prevalence of suicide in children, Baer states that the most important are mental disturbances, such as the insanities, and the emotions—love, hatred, jealousy, etc. In some cases alcohol was a predisposing factor. Poverty, hunger, fear, the early development of puberty, and lack of education all lead to suicide.

DISEASES OF THE BLOOD AND DUCTLESS GLANDS.

Anæmia. Rotch and Ladd² present an extensive paper on pernicious anæmia in infants, with a preliminary report of a case. They base their diagnosis on the following features: (1) The insidious onset, with moderate and paroxysmal attacks of indigestion; (2) the extreme pallor and great loss of strength; (3) the absence of any possible demonstrable cause for secondary anæmia; (4) the slightly elevated temperature for months; (5) the absence of glandular or splenic enlargements; (6) presence of the pronounced typical changes of the blood of pernicious anæmia; (7) the absence of any considerable degree of leucocytosis; (8) rapid improvement until the infant in all respects appeared to be absolutely sound, which in itself is typical of the remission which often occurs in pernicious anæmia. In the treatment, feeding is of the greatest importance. Arsenic may be tried cautiously,

¹ Philadelphia Medical Journal, September 29, 1901.

² Archives of Pediatrics, September, 1901.

for it is apt to upset the stomach. Bland forms of iron may be given, and laxatives are of importance. In the case reported good results seemed to follow the inhalation of oxygen. In discussing the case, Wentworth spoke at some length upon the results of blood examination in infancy. Such men as Grawitz, Strümpell, and Von Noorden are agreed that the diagnosis of pernicious anæmia in the adult cannot be made from an examination of the blood alone. The blood changes that were considered at one time typical of pernicious anæmia have been found associated with various chronic diseases, and the deductions that can be made from the examination of blood in infancy are much less reliable than in adults. Koplik also asserted that in studying infants' blood it is difficult to interpret what we see and to compare the appearances with those of adults. J. L. Morse also declared that the rules of blood diagnosis in adults do not apply in the diagnosis of the various conditions of the blood in infancy. The attempt to apply the same rules in infancy will surely lead to errors in diagnosis.

The Blood in Infancy and Childhood. In an extended paper upon this subject Stengel and White¹ describe the various methods of blood examination and the changes which take place under various conditions. The paper is well worthy of the study of those interested in the subject. Morse² presents a valuable paper upon the Widal reaction in infancy and childhood. He believes it safe to conclude that the Widal reaction occurs under the same conditions and with the same limitations in children as in adults. There is some evidence to show, however, that in them the reaction appears earlier, is feebler, and persists for a shorter time than in adults. In early infancy, therefore, a positive Widal reaction is of somewhat less diagnostic value than in older children and adults. If the mother has had typhoid, and especially if she is nursing the infant, it should be looked upon with some suspicion unless associated with other characteristic signs of typhoid. Examination of the mother's blood and milk and the cessation of breast feeding will then assist in estimating the true value of the reaction in the child.

Diseases of the Thymus Gland. SUDDEN DEATH in infants is not uncommon. In young infants it may result from internal hemorrhage, malformations, or atelectasis, or from asphyxia due to overlying or the aspirating of food or foreign bodies into the larynx. Marasmic babies and those ill with diarrhœal diseases sometimes die suddenly from exhaustion. Children may die suddenly with convulsions. Asphyxia associated with enlargement of the thymus occurs sometimes, but its frequency has no doubt been overestimated. Taillens,³ in considering

¹ Archives of Pediatrics, April and May, 1901.

² Ibid., May, 1901.

³ Revue Méd. de la Suisse Rom., June 20, 1901.

death due to hypertrophy of the thymus, believes that the mechanism of the accident varies as it follows a convulsive form, producing sudden death by action on the heart, or a compressive form, which acts slowly by asphyxiation.

Several cases of death apparently due to this cause have been recently reported. Bovaird¹ presented specimens taken at autopsy from an infant, aged four months. There were evidences of rhachitis, and the thymus was greatly enlarged. The cervical, bronchial, and mesenteric lymph nodes were moderately enlarged. Examination of the brain, trachea, larynx, and bronchi was negative. Holt² said he had seen four cases quite similar to this one, and he was not yet convinced that the condition of the lymphatics was more important than the size of the thymus. It was difficult to say what was the cause of the sudden fatal attack. He had seen cases in which it was apparently caused by the upward pressure of a distended stomach or colon. Heiman thought that death was caused in these cases of enlarged thymus by pressure on the recurrent laryngeal nerve.

Freidjung³ gives what is undoubtedly the present belief upon the question of thymic asthma and its relation to the so-called lymphatic state. The discovery of enlarged thymus glands in infants who had died in an attack of laryngospasm, with the absence of other pathological changes, had suggested to Kopp, in 1829, the theory that the two conditions stood in causal relation. But in 1847 Freidleben opposed this theory after carefully measuring and weighing a large number of the thymus glands of infants, saying that the cases of hypertrophy mentioned by different authors were still within physiological limits; that this condition was often found in perfectly healthy children, and was dependent on the state of general nutrition. He concluded that there was no thymic asthma. This conclusion was generally accepted, though some anatomists, among them Virchow and Cohnheim, had found thymus glands which, in their opinion, had very probably excited dyspnoea by their pressure, so that gradually the following theory prevailed: that laryngospasm has, as a rule, nothing to do with the thymus gland, but in rare cases an abnormally enlarged gland might cause respiratory disturbances and even sudden death. After that a series of cases with the following history was reported: Children under two years of age were either found dead in bed or had died suddenly while playing. Others had died suddenly in an attack of laryngospasm. In most instances the only pathological condition found was hypertrophy of the thymus, and death was explained by pressure on the trachea or on the

¹ Archives of Pediatrics, March, 1901.

² Ibid.

³ Archiv f. Kinderheilkunde, Band xxix., Heft 6; Archives of Pediatrics, May, 1901.

large vessels of the mediastinum, or on the vagus or its branches. Paltauf, having made a thorough study of the anatomical reports of these peculiar cases, found that in the majority of them, beside hyperplasia of the thymus, there was that same condition in the majority of the other lymphatic structures. Escherich and others add similar cases and accept Paltauf's theory that this general lymphatic state predisposes, in some way as yet unexplained, to sudden death, especially during operations. This, however, does not explain all cases of sudden death. Some cases certainly seem to be due to enlarged thymus gland. Several have been reported in which, during operation, respiration took place normally as soon as the gland was lifted, and stridor returned as soon as it dropped back on the trachea. Freidjung formulates his conclusions thus: There are certain rare cases of sudden death due to pressure of an enlarged thymus on the trachea or some other important structure, but in the majority of instances the sudden death is due to the general lymphatic state.

Cretinism. The usual number of cretins has been reported during the year. The same brilliant results from the use of thyroid extract are reported as heretofore. D'Arcy Power¹ presented a case of interest chiefly from the length of time it had been under treatment—eight years. The child had shown a sustained improvement. He was passing creditably through his school life, though his parents were wisely adverse to having him pushed. He was now eleven years old. Robert Hutchison remarked that under thyroid treatment there was generally greater improvement in the bodily than in the mental condition, but this case showed how much might be done to improve the intelligence if treatment were commenced early in life.

Hamill² exhibited a case which Hare thought of interest because it was one in which it was justifiable to attempt transplantation of the thyroid. The operation is an old one, and while it has not always proved successful it has had valuable results in some cases, and can be carried out without much danger to the patient. It was, of course, possible that the operation might not be successful or might have to be repeated before it was successful. Nevertheless, he thought that repeated attempts were justified. Packard and Hand³ present a contribution to the pathological anatomy of sporadic cretinism of great interest. Millet⁴ presents some interesting statistics regarding the disease. In the eastern part of France there are as many as 32 cretins per 1000, and 111 cases of goitre per 1000. In the whole of France over

¹ Archives of Pediatrics, October, 1901.

² Ibid., January, 1901.

³ American Journal of the Medical Sciences, September, 1901.

⁴ Boston Medical and Surgical Journal, October 10, 1901.

125,000 cretins and idiots are believed to exist. In Switzerland and in Austria the number is fully as great. Less than 100 cases of the sporadic cases are all that have been reported in North America.

The question of the dosage of thyroid extract was discussed at considerable length last year.¹

DISEASES DUE TO FAULTY NUTRITION.

Diseases of Nutrition. In a short but excellent paper on this subject, Rotch brings within this category rickets, scurvy, infantile atrophy, and osteomalacia. The latter, although a disease of adult life, occurs also in children. Rotch believes that if less attention were paid to the use of drugs in the various disturbances of the gastro-enteric tract in early infancy, and more enlightened methods of feeding were generally adopted, it would be possible to eradicate this entire group from the diseases of early life, and thousands of lives would be saved.

Rickets. After an extended study upon the pathogenesis of rickets, Pritchard,² of London, reaches the following conclusion: 1. Rickets may be explained by the presence of an excess of lactic and other acids in the system. 2. Excess of lactic acid may be generated when the food-supply (carbonhydratic chiefly) is relatively excessive or when the available oxygen is relatively deficient. 3. Infants fed on excessive diet can develop rickets, although no element necessary for metabolism is absent from the food. 4. Such cases can be cured by reducing the food to normal proportions. Spillman³ has studied rickets produced in animals by unhygienic surroundings. As in infants, the first symptoms were indigestion, distention of the abdomen, and delayed dentition, followed by bony deformities. In attempts to produce the disease by bad feeding, digestive symptoms appeared, but not the bony changes. The author concludes that rickets is a specific intoxication, derived from the digestive tract, which causes wide-spread osteitis. Under the rather clever title "Two Starvations," O'Day⁴ treats of rickets and scurvy, regarding them both as due to defects in nutrition. He gives some excellent advice upon feeding in both conditions. Spillmann⁵ examined the bones of several children dying from rickets, and regards the disease as an osteitis of the portions under the periosteum and about the epiphysis. A case of so-called fetal rickets is reported by Ashby.⁶ The mother was aged forty-six years, and the infant was her four-

¹ PROGRESSIVE MEDICINE, March, 1901, p. 281.

² Archives of Pediatrics, February, 1901.

³ Archives de Medecine des Enfants, May, 1901.

⁴ Pediatrics, April 15, 1901.

⁵ Revue Mens. des Malad. de l'Enf., January, 1901.

⁶ Archives of Pediatrics, October, 1901.

teenth, born at term and well nourished. When seen at two weeks there were craniotabes, deformed chest, and five fractures, including both humeri, left radius, right ulna, and left femur. Three weeks later the right femur fractured. The infant eventually made a complete recovery. Ashby doubted if such cases are true rickets. They rather resemble the osteoporosis produced by feeding puppies on food deficient in salts of lime. Fede and Finizio¹ report a series of observations upon 475 newborn infants. In three of these only were symptoms of rickets present, and three others had craniotabes. Microscopical examination was made of the bones of six infants dying at or soon after birth, but evidence of rickets was not found in any of them. These observations confirm the present belief that foetal rickets is very rare; that open sutures and large fontanelles may be only the evidence of retarded ossification.

TREATMENT. In an editorial article upon this subject² some of the earlier theories for the causation of rickets are referred to. These led to the administration of lime and other forms of bone-making material. The use of condensed milk is strongly condemned, as it not only produces a rhachitic condition, but babies fed upon it, although becoming fat, have not resisting power. Not entering upon the much-debated point of the value of phosphorus in rickets, the writer inclines to the belief that it may be valuable in some conditions, but useless in others. He asserts that it is best given in pink granules containing $\frac{1}{200}$ grain. Pritchard³ holds that the treatment of rickets, both prophylactic and remedial, may chiefly be considered from the point of view of alimentation and hygiene. The rhachitic infant is suffering from oxygen hunger, hence all measures which encourage respiration (cold douches, rapid movements through the air, light clothing, low temperatures) will quicken the vital processes. The hygienic and alimentary treatment is so eminently satisfactory that recourse to drugs is seldom necessary, but phosphates, phosphorus, and cod-liver oil are medicaments of proved value.

But few really satisfactory papers have recently appeared upon rickets. The disease has become so common, and the dietetic treatment is so important, that it seems proper to outline that treatment as it is now advised by the most competent authorities. A diet should be given as high in fat and proteid as the child can digest. The fat is of chief importance, that found in milk being the best. The carbohydrates should be reduced. Cod-liver oil should be given when the stomach will tolerate it. Fresh air, sunshine, bathing, and rubbing are impor-

¹ *Revue Mens. des Malad. de l'Enf.*, vol. xix., No. 3.

² *Therapeutic Gazette*, February, 1901.

³ *Loc. cit.*

tant factors in successful treatment. The proposition that rickets is due to the presence of lactic acid in the blood has not been accepted by most authorities.

Scurvy. Notwithstanding all that has been written upon the subject of scurvy, cases continue to be reported. When they come under the observation of medical men, however, they appear to be quickly recognized, and treatment is almost universally followed by marked and rapid improvement. The unanimity of opinion regarding the effect of diet in causing the disease is very noticeable. One of the best articles of the year is that of Louis Starr.¹ He has treated twenty-six cases, and reports an autopsy on a case that died. The distinguishing features of scurvy are: The development in infants from six months to two years of age, after the prolonged use of unsuitable food, of extreme hyperæsthesia and immobility of the limbs; swelling of the thigh above the knee-joint and of the leg above the ankle-joint; fusiform enlargement of the lower third of the shaft of the femur and tibia; purple discoloration, swelling, sponginess, and hemorrhage of the gums surrounding erupted teeth, anæmia, and, finally, the test feature, rapid and complete recovery following the adoption of antiscorbutic diet. As to causation, Starr asserts that the whole question may be stated in a few words: The cause of scurvy in infants is the continual deprivation of fresh food. The faulty foods may be classed in the order of their potency: 1. The different proprietary infant foods administered without the addition of cow's milk. These foods are responsible for the greatest number of cases. 2. Proprietary foods employed with an insufficient quantity of cow's milk. 3. Oatmeal, wheat, barley, and other farinaceæ administered with water alone or with water and insufficient milk. 4. Condensed milk and water. 5. Sterilized milk, consisting of milk mixtures subjected to a temperature of 212° F. from thirty minutes to an hour or more. 6. Too dilute milk and cream mixtures.

In a paper on the relation of infantile scurvy to diet, Griffith² says that a careful analysis of the statistics of the collective investigation of the American Pediatric Society, together with experience with the last sixteen cases under his observation, has convinced him of certain facts: 1. The use of proprietary infants' foods is a powerful factor in producing the disease. 2. The use of food containing converted or unconverted starch has a decided influence in many cases. 3. Cooking milk exerts a decided influence in many cases. This last point has, however, to be accepted with reserve, since in many instances reported we do not

¹ Philadelphia Medical Journal, April 27, 1901.

² Archives of Pediatrics, January, 1901.

know how the sterilized milk mixture was prepared. A faulty percentage proportion was probably the cause in many of them, and not the sterilization.

GENERAL DISEASES.

Diabetes. Diabetes is a rare disease in early childhood. It sometimes occurs, however, and is prone to run a rapid and very fatal course. A case is reported by W. E. Young,¹ in a foundling about six months old. It died one month after the first symptoms appeared. The following statistics are quoted by Young as showing the frequency in infants. West, in 1859, reported 700 cases, and only 1 was under five years. In 1899, Ashby and Wright reported 111 cases, ranging from six months to fifteen years. J. Lewis Smith, Meigs and Pepper, and Henoch do not report any cases. Oppenheimer, in 1900, reported but 2 cases. Holt, in 1898, quoted 1360 cases by Pavy, and only 8 were under ten years; 700 cases by Prout, with only 1 under ten years; 380 cases by Meyer, and only 1 was under ten years. Cotton² reports a case of diabetes in a girl, aged six years, who died in diabetic coma six weeks after coming under observation. In the advanced stage of this disease he says that the young child suffering from diabetes presents a picture of extreme inanition, emaciation, muscular weakness, dry skin and hair, brittle nails, extreme irritability, and sensitiveness to cold, while the urinary symptoms are always present. Furunculosis and other skin lesions rarely appear in children. No routine treatment is applicable to even the majority of these cases. At the present time the regulation of the diet seems to be the most important therapeutic measure. The death certificate follows hard upon the diagnosis, and the rate of mortality is very high.

A case of diabetes in a child, aged about four months, is reported by Orlow.³ The cardinal symptoms of diabetes—namely, polyuria, polyphagia, and autophagia—were present. The child had a number of boils on its body, and died on the twelfth day. As effusion into the third ventricle was found at the autopsy, the claim is made that this is the first case of genuine diabetes in an infant recorded. Noskow⁴ reports the case of a boy, aged three and one-half years, who, after an attack of grip, developed an enormous appetite, extreme thirst, emaciation, debility, and polyuria. The urine was found to contain 4.8 per cent. of sugar and acetone. He died in a state of coma which lasted

¹ Archives of Pediatrics, March, 1901.

² Journal of the American Medical Association, September 7, 1901.

³ Vrach, March 3; Philadelphia Medical Journal, March 27, 1901.

⁴ Ibid.

forty-eight hours. Baumel reports a case of diabetes in an infant, aged six months, which he believed to have been due to the nervous effect of teething upon the pancreas. Le Gendre¹ reports a case of subacute diabetes in a child, aged twenty-two months. Several other cases have been reported during the year in children between four and ten years of age.

It seems either that diabetes was formerly not recognized in young children, or at least was not reported, or that it is increasing in frequency.

Rheumatism. In a paper upon the pathogenesis of acute rheumatism in children, Heiman² reviews the various theories proposed. The most plausible of these, he believes, is the one which attributes the disease to the germ theory. Although the specific organism has never been isolated satisfactorily, there are grounds for believing that the time is not far distant when it will be. There are certain features which are almost *sui generis* to children. Thus there is less liability to joint involvement, and sometimes it may be altogether absent. Sometimes the only evidence of joint implication is pain. When the joints are involved the changes are not so severe as in adults, there being less exudation and fewer structural changes, and therefore less pyrexia. On the other hand, there is in childhood a greater tendency to involvement of other tissues. We therefore have as a frequent accompaniment torticollis, erythema nodosum, purpura rheumatica, endocarditis, pericarditis or even myocarditis, and a formation of tendinous nodules. The most frequent complication in childhood is endocarditis. While rheumatism is rare under three years, numerous authentic cases have been reported.

In discussing this paper, Jacobi³ commented on the trend of modern opinion in the direction of the microbic theory. It is not improbable that staphylococci and streptococci, and perhaps other organisms, are concerned in its production. There is good reason for believing that these germs gain entrance through the throat in many instances. As a matter of prophylaxis, large tonsils should be excised and adenoids removed. In an excellent paper upon rheumatism in children, Cheney⁴ agrees with all authorities that the joint symptoms are, as a rule, much less severe than those which occur in adults, while the tendency to heart involvement is greater. As rheumatic manifestations he regards chorea and tonsillitis as doubtful, while purpura and subcutaneous nodules are characteristic of the disease in children.

¹ Archives de Médecine, March, 1901.

² Archives of Pediatrics, January, 1901.

⁴ American Medicine, September 7, 1901.

³ Ibid.

TREATMENT. The first indication to counteract the poison, Heiman¹ believes, is met best by the salicylates. There are to-day no known drugs which can replace them or their derivatives, such as salol, salipyrin, etc. They are regarded by most practitioners as specific, but even with their employment, failures to cure or to prevent involvement of other organs occur from time to time. He also administers the salicylates prophylactically. Ewart, of London, is the only one who has alluded to this method of treating rheumatism. After the acute symptoms have subsided, and the little patient is apparently cured, the administration of the salicylates is continued in 3 to 5-grain doses three times daily, according to the age, for one week of each month for a year or longer. The principle involved in this prophylactic measure is that the bacteria and their toxins may remain dormant for a long period after the acute symptoms, and there is probably no antitoxin produced in the system to immunize it from subsequent attacks.

¹ Loc. cit.

PATHOLOGY.

By LUDVIG HEKTOEN, M.D.

THE current literature on pathological and closely related subjects has acquired so large dimensions that it long since became quite impossible for any single individual to cover the whole field and to give an intelligent, critical summary of the progress made in the various departments from year to year. The bibliographical lists alone would occupy an excessive amount of space in a publication like *PROGRESSIVE MEDICINE*; therefore, I have been forced to limit this review to what seemed to be the more important articles in the most prominent publications in the English, German, and French languages principally. Certain subjects, for instance malaria, yellow fever, and pure pathological anatomy in general, I have not touched upon at all, knowing that their great and direct practical importance secures for them adequate presentation in other sections. I have endeavored to confine myself to the original investigations in serum pathology, immunity, pathogenic micro-organisms, general pathological histology and oncology—a field assuredly comprehensive and varied enough. Much of the material presented must appear fragmentary and incomplete, which is necessarily the case, as it mostly concerns subjects still under active and progressive investigation.

A discovery of the highest importance—namely, of at least one mode of infection in yellow fever—has been made by American investigators during the past year. Concerning this epochal achievement, Ronald Ross, the noted investigator of malaria, makes this statement in an address before a section of the British Medical Association: “For some time past several of our American colleagues, stimulated by recent observations in connection with malaria, have sought an experimental verification of the hypothesis of Finlay and others that yellow fever also is communicated by the bite of gnats. Insects fed on patients were subsequently induced to bite healthy persons who volunteered for the experiment. The results were negative until the gnats were kept for an interval of twelve or more days between the two operations. Success was now immediate. Drs. Reed, Carroll, and Agramonte record in their last report that out of seven non-immune persons subjected by them to the bites of infected mosquitoes, six yielded undeniably

positive reactions. At the same time seven non-immunes whom they endeavored to infect by means of the fomites of patients under peculiarly favorable circumstances remained in every case free from the disease. The experiments were conducted under the most stringently scientific conditions. Although the mosquito theory of yellow fever does not possess the parasitological basis of the mosquito theory of malaria, yet the differential observations of Reed, Carroll, and Agramonte are of a nature to leave no doubt concerning the soundness of their conclusions."

Dr. Jesse W. Lazear heroically laid down his life in the cause of this investigation, and Dr. Walter Myers lost his life from yellow fever while on a mission to study this disease in South America. In the words of Professor Welch: "Both Lazear, of the American, and Myers, of the English Yellow Fever Commission, have laid down their lives in the search for means of prevention, based upon better knowledge of causation, of one of the most baffling and terrible scourges of mankind. How much more glorious is the cause to which these bright young lives were sacrificed than any for which nations are in arms to-day."

An event of great significance to scientific medicine is the establishment of the Rockefeller Institute for Medical Research. The purpose of this institute is to provide facilities for research, especially in the prevention and treatment of disease.

The first meeting of the Association of American Pathologists and Bacteriologists, held in Boston, April, 1901, marks another important step in the development in this country of the sciences represented. In order to secure prompt publication of the material presented at the meetings of this Association the *Journal of Medical Research* has been established, the scope of which is indicated by its title.

PRECIPITINS.

The new properties acquired by the serum of animals treated with certain cells, with microbes, toxins, diastases, and proteid substances, are proving a fruitful and wonderfully interesting field for study. By marvellous and intricate mechanisms, the finer details of which are not understood as yet, the organisms so treated react by producing a series of antibodies—cytotoxins, bactericidal substances, and agglutinins, antitoxins, antidiastases, and precipitins. The general trend of the numerous investigations along these lines during the past year, especially in Germany and France, I will endeavor to set forth under a number of separate headings.

Precipitins for Blood Serum and Other Substances. The latest development in the field indicated is the discovery of specific precipitating bodies for bacterial products, milks, peptone, and other proteids, but especially for blood and derivatives of blood. Nuttall,¹ in the best summary of this work yet at hand, states that Kraus,² in 1897, showed that certain bactericidal serums produced by immunization give specific precipitates with the filtrates of homologous cultures. Bordet found that the injection of milk brings about changes in the serum whereby precipitates result on mixing a few drops of the serum with milk. This observation has been confirmed by Fisch,³ of St. Louis, who found that the precipitins for cow's milk develop also after the injection of udder cells. In 1899 Tchistovitch stated that the serum of animals immunized against the highly toxic eel's serum causes precipitation when added to eel's serum outside of the body. The principles here illustrated have been utilized for the study of specific precipitins for blood serums by a number of observers with remarkably uniform results: Uhlenhuth, Wassermann and Schütze, Nuttall assisted by Dinkelspiel, and a number of others.⁴

TEST FOR HUMAN BLOOD. Uhlenhuth found that after five injections of 10 c.c. each of defibrinated beef blood into the peritoneal cavity of rabbits, the rabbit's serum not only causes agglutination and solution of the corpuscles of the beef blood, but also a flocculent precipitate in beef serum diluted with salt solution. This precipitating action has been found to be quite specific. Similar results were obtained with defibrinated human blood when injected into rabbits, the precipitins in this case also being specific, no precipitate appearing when the serum of the animals injected is added to other blood serums than human. These observations immediately suggested the value of this procedure as a means of differentiating bloods for forensic purposes. We have long been in need of a new and reliable method of differentiating between human and animal blood, because all previous methods have failed to furnish decisive criteria; and that this test is the most decisive and delicate now at hand will be evident from what follows. Uhlenhuth found that the

¹ *Journal of Hygiene*, 1901, i., 367-387.

² *Wien. klin. Wochenschrift*, 1897, x., 736-738.

³ *Lactosermum and Other Cell Sera*, St. Louis *Courier of Medicine*, 1900.

⁴ Dieudonné: *Münchener med. Wochenschrift*, 1901, xlviii., 533-534. Honl: *Wien. klin. Rundschau*, July, 7, 1901. Mertens: *Deutsch. med. Wochenschrift*, 1901, xxvii., 161-162. Nuttall: *British Medical Journal*, 1901, ii., 669, also 1141. Stern: *Deutsch. med. Wochenschrift*, 1901, xxvii., 135. Uhlenhuth: *Ibid.*, 1901, 7-9, and 260, 261. Wassermann and Schütze: *Berl. klin. Wochenschrift*, 1901, xxxviii., 187-190. Zullzer: *Deutsch. med. Wochenschrift*, 1901, xxvii., 219-220. Ziemke: *Ibid.*, 1901, xxvii., 424-426.

reaction could be obtained with human blood dried for four weeks ; even with the blood exposed to decomposition for several months ; also with menstrual blood, blood mixed with soapy water, and blood frozen for fourteen days at 10° C. In all these cases the test proved accurate and sensitive. Wassermann and Schütze confirm Uhlenhuth's observations. They tested the blood of twenty-three kinds of animals, and found the reaction specific for each, the only exception being monkey's blood, which shows a slight precipitate with human precipitin. They also obtained decisive results with blood that had been left unprotected for three months. They suggest that prepared rabbit's serum should be kept in readiness at certain designated institutes.

Stern obtained from rabbits, after injecting them with human blood serum, a serum that gave a precipitate with human blood, dried and dissolved corpuscles, albuminous urine, and with blood from certain monkeys (Kronen u. Javaaffen), but not with the blood of horses, cattle, sheep, and hogs.

Nuttall and Dinkelspiel also found that specific human precipitins caused a slight reaction in monkey's blood ; they tested no less than 140 bloods from all classes of vertebrates, but none except monkey's blood gave precipitate with antiserum for human blood—a fact that accords well with the Darwinian theory. Putrefied human blood diluted 1 to 100 with normal salt solution gave a marked reaction. A rabbit injected with some old antidiphtheria horse serum contained in its serum precipitating substances for horse's serum. They obtained a positive effect by injecting a rabbit with pleuritic fluid preserved for several months by means of chloroform. Dilutions of human blood—1 to 100—mixed with equal volumes of diluted ox, sheep, dog, and horse blood, gave definite precipitates with proper serums, showing that the test is reliable in mixtures of blood. All control experiments gave negative results.

Dieudonné obtained the reaction by injecting albuminous urine, pleural exudate, and placental serum. The serum of the rabbits treated with albuminous urine gave a distinct precipitate when added to albuminous urine. Normal urine did not produce precipitin in rabbits. Mertens reaches the conclusion, from experiments along these lines, that the albumin in nephritic urine is derived from the blood.

Leclainche and Vallée¹ found that by injecting rabbits with albuminous human urine a substance is formed in the serum of the rabbit that causes a precipitation of the albumin dissolved in the urine and in other organic liquids, the action being limited specifically to albumins that have transuded into certain pathological liquids. Heating to

¹ *Comp.-rend de Soc. biol.*, 1901, liii., 51-53.

58° C. for two hours does not destroy the power of the serum to precipitate albumin.

Blumenthal¹ shows that the repeated injection in rabbits of albuminous human urine and of serous exudates causes a specific precipitate when the serum is mixed with albuminous human urine or with human exudates.

We know nothing concerning the mechanism of the precipitation mentioned in the foregoing, nor of the nature of the precipitate. The precipitating factors in the serum of animals injected seem remarkably resistant, as the serum remains active after being heated to 60° C. for an hour or more. Uhlenhuth tells us that active serum may be preserved for three months or more by the action of 5 per cent. carbolic acid. Nuttall finds that chloroform also preserves serums.

Blood that is to be tested by this biological method may be preserved by means of chloroform, or, as has been indicated, it may be dried upon filter paper or other substance. The technique is very simple: A few drops of the serum of the animal, generally a rabbit, prepared by repeated subcutaneous or, preferably, intraperitoneal injections, are added to about 0.5 c.c. or so of a clear filtered dilution of 1 to 100 normal salt solution of the blood injected. Dried blood or serum may be dissolved in ten parts of normal salt solution and then diluted as above.

As far as we now know this method is specific, except that the same serum which causes precipitates in human serum also causes precipitates in the serum of certain monkeys (Uhlenhuth and Nuttall).

Recently Farnum,² in my laboratory, has applied successfully the biological method as a test for semen, producing in animals by injections of semen precipitins for the latter.

Precipitins for Proteids. Myers³ injected, in increasing doses, proteids such as crystallized egg albumin, serum-globulin, and Witte's peptone. Crystallized albumin gives rise in the serum of the animal injected to an antiproteid which causes precipitate in egg albumin. Serum-globulin (sheep's) produces a substance that precipitates the serum-globulin; at the same time substances agglutinating sheep's corpuscles appear in the serum of the injected animal; and solutions of Witte's peptone give rise to peptone-precipitating bodies in the animals injected.

Schütze used the biological method in order to study the proteids in

¹ Arch. russes de Path. de Méd. clin. et de Bacteriol., 1901, xi., 627; abstr. in Journ. de Phys. et de Path. gén., 1901, iii., 861, 862.

² Transactions of the Chicago Pathological Society, 1901, v. 31-33, and the Journal of the American Medical Association, 1901.

³ Centralbl. f. Bakteriol., Abth. I., 1900, xxviii, 237-244.

various milks. Specific lactoserums are produced by injecting rabbits with the milk of various animals, including that of woman, thus showing that the proteid molecules of different kinds of milk differ from one another. Boiling milk for half an hour so alters its molecules that no precipitate is formed by the corresponding lactosermum. The biological test thus shows the manifold nature of physiological products more accurately than possible by ordinary chemical means. Each animal has its own milk, and real substitutes for human milk have probably not yet been made.

Kowarski¹ studied the vegetable albumins according to the principles above outlined, and found that they differ less from one another than animal albumins.

Anticoagulative Serum. Camus, Bordet and Gengou, and others have studied anticoagulative serums. Their action resembles much those of alexins. Bordet and Gengou² used the plasma of birds (geese, chickens) as a test for the fibrin ferment of various animals because the bird's serum contains but very little ferment, and hence remains liquid for a long time outside the body. The plasma of the rabbit and guinea-pig contains abundant fibrin ferment. They emphasize the importance of a certain form of contact phenomenon of a purely physical nature in the coagulation of the serum, which may be kept liquid for some time in tubes coated with paraffin, whereas it coagulates rapidly when brought in contact with glass even when freed from cells. The serum of animals of species A injected with the serum of animals of species B acquires the power to suspend or neutralize the fibrin ferment of B—*i. e.*, it becomes anticoagulative. The anticoagulative power is practically specific, showing that fibrin ferments of various species, though similar in action, are not quite identical. The anticoagulative substances resist heating to 58.5° C.

CYTOTOXINS.

The following abstracts of articles in regard to cytotoxins of animal origin are given without comment, as showing the direction in which the investigations are being carried.

Nephrotoxic Serum. Nefédieff³ presents a study of nephrotoxic serum. He prepared a sterile emulsion of the kidneys of guinea-pigs, which he then injected into rabbits. The rabbit's serum became toxic for guinea-pigs, which died in a few days after having been injected with a dose of 10 c.c. of serum for each kilo of

¹ Deutsch. med. Wochenschrift, 1901, xxvii., 442.

² Ann. de l'Institut Pasteur, 1901, xv., 129-144.

³ Ibid., 17-35.

animal. The serum was found to have a special action on the kidneys, as shown by albuminuria and by anatomical changes of a degenerative character in the kidneys. This action is claimed to be quite specific, and the changes described did not follow the injection of normal rabbit's serum nor of serum made hæmolytic for guinea-pigs. Reversing the conditions, it was found that the serum of guinea-pigs could be made feebly nephrotoxic for rabbits. Not wholly satisfied with the results from experiments like these just referred to, Nefédieff ligated one ureter in various rabbits, and several weeks later he would inject serum from such animals into the ear vein of healthy rabbits. These experiments were based on the consideration that ligature of the ureter leads to the accumulation of toxic material in the organism. The injected animals developed albuminuria, from which recovery took place. In one rabbit with albuminuria, which was killed on the seventh day, the kidneys showed marked degenerative parenchymatous changes, with some intertubular round-cell infiltration. Nefédieff believes that the toxic substance may be derived either from the kidney the ureter of which is tied or from the accumulation in the blood of substances that are eliminated under normal conditions. At all events the nephrotoxin studied in the last series of experiments is an isotoxin. Further studies may throw light on some of the as yet obscure points as to its place of origin, etc.

Bierry¹ claims that the blood of rabbits injected with emulsions of the boiled kidney of a dog becomes toxic for dogs. The serum of dogs whose renal artery is tied is said to be nephrotoxic.

Hobbs² states that the serum of an uræmic patient caused diffuse nephritis in guinea-pigs.

Neurotoxic Serum. Delezenne,³ in order to obtain an active artificial neurotoxic serum, gave ducks several intraperitoneal injections of aseptic emulsions of the brain and cord of the dog, the doses being increased from 8 or 10 c.c. to 15 or 20 c.c.; and then dogs were injected with the serum of the ducks, which was found to be much more toxic than normal serum. Intracerebral injections of the neurotoxic serum produces marked nervous symptoms and often sudden death. The neurotoxic serum is to a certain degree specific in its action.

Centanui⁴ obtained a neurotoxic serum by prolonged injection into sheep of the brain substance of a rabbit. The introduction of $\frac{1}{2}$ c.c. of this serum into the brain of a rabbit produces the symptoms of paralytic rabies. The ganglion cells swell up, become vacuolated, and undergo chromatolysis. Injections into the vessels are tolerated readily,

¹ Comp.-rend. de Soc. biol., 1901, liii., 839, 840.

² Ibid., 482.

³ Ann. de l'Institut Pasteur, 1900, xiv., 686-704.

⁴ Rif. med., 1900, iv.; abstr. in Centralbl. f. Path., 1901, xi., 337.

presumably because the endothelial cells protect the brain substance. Antineurotoxin is obtainable by the usual methods.

Enriquez and Sicard¹ injected emulsions of dog's brain into the abdominal cavity of rabbits, and then they injected the serum of two rabbits, which survived the third inoculation, into the subcutaneous tissue and into the brain of dogs. The subcutaneous injections did not produce any symptoms, but the intracerebral inoculations were followed by marked nervous symptoms, from which recovery took place.

Antihepatic Serum. Delezenne² reports that rabbits or ducks that have received a series of intraperitoneal injections of emulsion of the liver of dogs furnish a serum that is toxic for dogs and produces in the fatal cases an extensive necrosis or fatty changes in the liver.

Adrenal Serum. Bigart and Bernard³ injected into the abdomen of ducks an aqueous extract of the adrenals of guinea-pigs. The serum of ducks so treated was then injected into the jugular vein of guinea-pigs, which fell sick and died, the adrenals being swollen, the central parts decolorized and softened. The microscopical changes were marked. Naturally these experiments were verified by proper control experiments. The authors propose to use the method indicated for the study of the physiology of the adrenal.

Pancreatic Cytotoxin Surmont⁴ prepared a pancreatic cytotoxin for dogs by injecting into the peritoneal cavity of rabbits an emulsion of the pancreatic cells of the dog. The injections must be made in small, gradually increasing doses, because of the toxic action of dog's pancreas for rabbits. The serum which results may cause in dogs rapid death, death at the end of several days with temporary glycosuria, or merely a temporary illness. Marked changes are produced in the pancreas. This antipancreatic serum has a marked antitryptic action.

Carnot and Garnier⁵ have also been studying pancreatic cytotoxins, with variable results. The histological changes are not definite or distinctive.

Placentolysin and Syncytiolysin. Such substances are said by Veit⁶ to form in the serum of the goose on inserting into its abdomen cells scraped off from the surface of the rabbit's ovum. He finds that there are no hæmolysins in the maternal blood for the foetal, or *vice versa*, but suggests that should placental cells enter the maternal circulation in large numbers a placentolysin with toxic properties might develop and cause eclampsia. Further studies are necessary.

¹ Comp.-rend. de Soc. biol., 1900, lii., 905, 906.

² Comp.-rend. Acad. des Sci., 1900, cxxxi., 427-429.

³ Comp.-rend. de Soc. biol., 1901, liii., 161-163.

⁴ Ibid., 445, 446.

⁵ Ibid.

⁶ Centralbl. f. allg. Path. u. path. Anat., 1901, xii., 642.

HÆMOLYSIS.

Much attention continues to be given to hæmolysis under various conditions. The Ehrlich school finds here the most fertile field for investigations bearing directly or indirectly upon the theories of immunity. Much of the work on hæmolysis belongs to physiology, strictly speaking, but just at present the results are of especial interest from the stand-point of pathology and bacteriology. Efforts are being made also to find practical applications for hæmolytic reactions in clinical medicine.

As further examples of hæmolysis¹ the following is cited: Krompecher² studied the action of defibrinated frog's blood upon the blood-corpuscles of the rabbit. A drop of rabbit's blood mixed with a drop of frog's blood showed solution of the red globules of the rabbit. Frog's serum heated to 55° C. for half an hour, or kept at room temperature for twenty-four hours, loses this solvent power, but agglutinates the rabbit's corpuscles. It is reactivated by a drop of peritoneal fluid of the frog. Repeated injections of rabbits with suspensions of red corpuscles of frogs and of defibrinated frog's blood produced substances in the rabbit's serum that dissolved the corpuscles of the frog's blood, preceded by agglutination; the nuclei of frog's corpuscles were also dissolved. Substances that prevent the hæmolytic action of frog's serum were also formed in small quantities.

Metelnikoff³ finds that hæmolytic serum may be obtained by feeding of blood just as well as by the injection of blood. His experiments were made with white rats, which were given horse's blood to eat, and after a time the rat's serum acquired marked agglutinating and hæmolytic action toward the horse's blood. Reasoning from analogy, it seems likely that the organism may elaborate cytotoxins for other cells fed to it.

Meltzer⁴ shows that normal bovine serum (shown by Meltzer to be strongly hæmolytic for rabbit's corpuscles) kept for three hours in the abdominal cavity of a rabbit loses wholly its hæmolytic effect on rabbit's corpuscles. The serum was not reactivated by any of the known methods ordinarily employed for that purpose. He found, further, that it is quite impossible to activate bullock's serum once rendered inactive. The result is not due to the development of an antihæmolysin, because peritoneal bullock's serum had no influence upon the

¹ See PROGRESSIVE MEDICINE, March, 1901, p. 922.

² Centralbl. f. Bakteriöl., Abth. I., 1900, xxviii., 588-594.

³ Ibid., 1901, xxix., 531-533.

⁴ Ibid., xxx., 278-281. Medical Record, 1901.

hæmolytic effect of normal bullock's serum. The hæmolytic action is lost also when bullock's serum is kept in the peritoneal cavity of a dead animal.

Immune rabbit's serum also loses its hæmolytic action on guinea-pig corpuscles when kept in the abdominal cavity for three hours, retaining, however, its power to agglutinate guinea-pig corpuscles. In this case reactivation promptly occurred on adding the serum of normal rabbits. It seems that the loss of hæmolytic action is probably due to the absorption of the elements necessary as a result of osmosis and inhibition.

Meltzer makes the interesting observation that in immunizing rabbits with the blood of guinea-pigs, which was injected into the ear vein in doses of 1.5 c.c. at intervals of five to six days, a fourth injection was sure to kill the animals, probably from thrombosis either by agglutinated foreign corpuscles or by the masses of the stroma of dissolved red corpuscles.

Antihæmolysins. Theodore Müller¹ has studied the antihæmolytic substances of normal serums. He shows that quite a series of normal serums are able to protect the red corpuscles of the rabbit against the strongly hæmolytic action of the serum of the duck. This antihæmolytic action may appear only after the serum has been rendered inactive by heat, because then its own hæmolytic powers are destroyed. The antihæmolytic action seems to depend on the power of the serums to bind the complement.

Paul Müller² finds that by injecting rabbits with heated chicken serum there is developed an antiserum which protects the red blood cells of the rabbit against the hæmolytic action of chicken serum.

Kraus and Clairmont showed that normal horse serum prevents hæmolysis of rabbit's blood; and Neisser and Wechsberg found in normal human serum an antibody against the hæmolytic staphylotoxin; and the late Walter Myers studied the interaction between cobra-lysin—a hæmolytic constituent of the venom of cobra capella—and its antitoxin.³

Bacterial Hæmolysins. William Bulloch and William Hunter⁴ found a hæmolysin in cultures of bacillus pyocyaneus ("pyocyanolysin") which causes diffusion of the hæmoglobin of the corpuscles of oxen, sheep, rabbits, and other animals. This substance develops in the bodies of the bacteria, and in greatest quantity when the cultures are from three to four weeks old. In old cultures the lysin passes over

¹ Centralbl. f. Bakteriöl., Abth. I., 1901, xxix., 860-873.

² Ibid., 175-187.

³ Trans. London Path. Soc., 1900, li., 195-216.

⁴ Centralbl. f. Bakteriöl., Abth. I., 1900, xxviii., 867-876.

into the medium. When in the bodies of the bacilli the substance resists heat longer than when diffused into the filtrate; in the latter case it is destroyed by heating to 100° C. for fifteen minutes. The lysin is not identical with the pyocyanase of Emmerich and Low, nor with the pyocyanous toxin usually obtained by filtering bouillon cultures.

Weingerhoff¹ also finds that pyocyanous produces a hæmolysin especially active for the red cells of the dog, the guinea-pig, and rabbit. Heating up to 120° C. for thirty minutes does not destroy the hæmolytic nor the general toxic properties of the toxin. He points out that the English writers used a 0.6 per cent. solution of salt instead of 0.85 per cent., as recommended by Ehrlich and others. Hæmolysis may take place, he says, in 0.5 per cent. salt solution alone. He confirms Bulloch and Hunter's statement that the hæmolytic and toxic constituents of bacillus pyocyanous are not identical.

Neisser and Wechsberg confirm Kraus in the observation that staphylococcus pyogenes produces a hæmolysin. Normal human and immune serum contains a substance which prevents the action of staphylolysin.

Lubenau² reports the results of studies on the hæmolytic properties of a number of bacteria.

E. and P. Levy³ find that in bouillon cultures of typhoid bacilli there forms a hæmolysin for the red corpuscles of the dog. This hæmolysin is not inactivated by heat. Antihæmolysin was obtained by repeated injections of typhoid cultures killed by 50° C. heat.

Hæmolysis by Cerebro-spinal Fluid, Urine, etc. Bard⁴ has studied the tonicity of the cerebro-spinal fluid by noting its action upon the red blood cells of the owner. (In five cases the liquid was hypertonic; in five hypotonic; in one of the hypertonic the fluid was red in color before the addition of blood.) He added a drop of blood to a small quantity of fluid, and centrifugalized the mixture after a thorough shaking, the coloration of the supernatant fluid indicating the absence or presence of hæmolysis. Similar results may be secured by sedimentation. Cerebro-spinal fluid of normal tonicity does not lase the blood, laking taking place only after the addition of nine drops of distilled water to ten of fluid. When hypotonic, laking occurs more or less promptly, and a characteristic blue reaction is obtained by means of guaiac and turpentine. He recommends this method in preference to cryoscopy⁵ as being easier of appli-

¹ Centralbl. f. Bakteriöl., Abth. I., 1901, xxix., 777-781.

² Ibid., xxx., 356-367 and 402-405.

³ Ibid., 405-407.

⁴ Comp.-rend. de Soc. biol., 1901, liii., 167-170.

⁵ For cryoscopy of cerebro-spinal fluid in meningitis, etc., see Widal, Sicard, and Rivaut: Comp.-rend. de Soc. biol., 1900, lii., 859-863. Widal, Sicard, and Monad: Ibid., 901-904. Castaigne: Ibid., 907-908. Achard, Loeper, and Laubry: Arch. de Méd. exp. et d'Anat. path., 1901, xiii., 567-574.

cation and more sensitive, the quantity of fluid required being also much less.

Bard¹ found that in two cases of tuberculous pleuritis, and one developing in the course of typhoid and puerperal infection, the fluid did not contain hæmoglobin, but in one case of carcinoma of the peritoneum and in two of carcinomatous pleuritis the fluid contained hæmoglobin. Whether due to hypotonicity or to the presence of special lysins was not determined.

Milian² observed marked hæmolysis in sarcoma of the pleura and also in hemorrhagic pleuritis due to pulmonary gangrene, but not in traumatic hæmothorax. Julliard³ found that in traumatic hemorrhages in bursæ and joints hæmolysis is most marked early after the effusion.

Neisser and Doering⁴ found the serum of twenty patients of various kinds lytic for the corpuscles of the rabbit. The lysin has the same constitution as other normal and immune hæmolytic serums, being rendered inactive by heating to 56° C. for thirty minutes. Widal states that the serum of typhoid patients causes rapid diffusion of hæmoglobin of corpuscles of a normal patient, but does not affect those of typhoid patients.

Sabrazes and Fauquet⁵ find that prolonged milk diet under normal as well as pathological conditions gives the urine the power to quickly lake red blood cells. This property always depends upon hypochloruria. The same authors⁶ found that the first urine voided by newborn children before any nourishment has been taken is also hæmolytic. The freezing-point of this urine is -0.18 to -0.22° C. In nursing dogs they found that the urine is not hæmolytic.⁷

Amédée Pognat,⁸ taking the hint from the above investigations, examined the hæmolytic action of the urine in pneumonia. In this disease the urine is very poor in chlorides. In nine cases the urine did not lake the blood, the freezing-point being above that of blood. Hence he concludes that the degree of concentration is the determining factor in laking of blood by urine.

But urine may cause laking of blood by virtue of the presence in it of hæmolytic substances, which are directly toxic for red corpuscles. Thus Camus and Pagniez⁹ believe that hippuric acid in human urine causes laking of rabbit's corpuscles. Under pathological conditions there may be found hæmolytic ferments in the urine which are destroyed

¹ Comp.-rend. de Soc. biol., 1901, liii., 170, 171.

² Loc. cit., 207.

³ Berl. klin. Wochenschrift, 1901, xxxviii., 593-595.

⁴ Comp.-rend. de Soc. biol., 1901, liii., 273, 274.

⁵ Ibid., 372.

⁶ Ibid., 395, 396.

⁷ Journ. de Phys. et de Path. gén., 1901, iii., 592-598.

⁸ Loc. cit., 629-630.

⁹ Ibid., 464.

by heating to 55° C. for some minutes. Camus and Pagniez cite such cases. If blood enters the urinary tract under such circumstances there may result hæmoglobinuria without hæmoglobinæmia being present at the same time.

Friedberger¹ finds that the urine of rabbits immunized against pigeon's blood agglutinates and dissolves the red corpuscles of the pigeon, showing that specific agglutinating and hæmolytic substances pass into urine. The blood serum in the rabbits in these experiments had strong agglutinating powers.

The hæmolytic action of the serum in paroxysmal hæmoglobinuria has been studied by Martini,² but without arriving at any definite conclusions.

Schattenfroh³ finds that the injection of urine (human, goat's) into rabbits gives rise to substances that agglutinate and dissolve the corpuscles of the species furnishing the urine. Precipitins and anticomplements did not develop, at least not when the urine of goats was used. Heating the urine to 100° C. for five minutes destroys the power to produce lysins.

Agglutination of Red Corpuscles by Serum. Camus and Pagniez find that normal human serum does not agglutinate the corpuscles of another individual, but in pathological states (anæmia, cachexia of various kinds, especially tuberculous) the serum may have marked agglutinative power as regards the corpuscles of normal persons. Lomonaco and Panichi show that malarial blood acquires agglutinating properties, and Grijoni⁴ states that the serum of malarial patients agglutinates the corpuscles of other persons so markedly as to be of diagnostic value in latent malaria. Quinine is said to have a marked anti-agglutinating effect.

Ascoli⁵ studied the action of the serum on human corpuscles from patients with different diseases. In anæmia agglutination and hæmolysis occur readily. Typhoid agglutinins have but slight agglutinating power on human red corpuscles. He favors the idea that rouleaux formation is an isoagglutination, at least in part.

Mechanism of Globulolysis. Nolf⁶ made a careful comparative study of the mechanism of globulolysis by chemical agents, by bile, and by normal and immune serums. The remarkable researches of Hedin⁷ show that with respect to their action on red corpuscles chemical agents may be divided into two classes—non-penetrating substances

¹ Berl. klin. Wochenschrift, 1900, xxxvii., 1236-1239.

² Rif. med., 1900, iv., Abstr. in Centralbl. f. Path., 1901, xii., 372.

³ Münchener med. Wochenschrift, 1901, xlviii., 1239.

⁴ Gazz. degli Ospedali, May 12, 1901.

⁵ Münchener med. Wochenschrift, 1901, xlviii., 1239-1241.

⁶ Ann. de l'Institut Pasteur, 1900, xiv., 656-685.

⁷ Arch. f. gesammte Phys., lxxviii.

and penetrating substances—the latter alone causing a diffusion of hæmoglobin. Chemical hæmolytins are divisible into two groups: 1. Solutions like that of urea, which act like water, the action being suspended by isotonic NaCl solution. 2. Solutions of NH_4Cl , which are more destructive and whose action is not suspended by NaCl. Nolf holds that the diffusion of hæmoglobin is a result of a hydration of the stroma of the corpuscles. That there is an actual swelling of the corpuscles in hæmolytic solutions is determined readily by means of centrifugalization. Normally the wall of the corpuscles¹ maintains an equilibrium between the substances in the serum and the corpuscular fluids. When the serum is diluted so that its concentration equals about 0.45 per cent. sea-water, hæmoglobin diffuses on account of hydration and permeabilization of the corpuscular wall; and solutions of NH_4Cl make the stroma absorb water with great avidity, even in the presence of isotonic NaCl solution. Equimolecular solutions of a number of substances, such as salts of potassium, barium, calcium, and magnesium, hinder or delay this action of NH_4Cl , even in dilutions of 0.1 N; this is especially so in solutions of the alkaline earths.

The sodium salts of the biliary acids are strongly hæmolytic, dissolving the entire corpuscles, and this action is favored more by solutions of the alkaline earths than by those of Na and K. This is due to the increase in the number of neutral but penetrating molecules at the expense of dissociated. K and Na ions are non-penetrating.

Nolf shows that the alexins of serums, contrary to Buchner's theory, do not have any peptonizing action on hæmoglobin or on the albuminoids of the corpuscles; hence the theory of the fermentative action of hæmolytic alexins must be abandoned. He shows that there is much in common between the action of chemical hæmolytins such as NH_4Cl and that of substances in normal or immune serum. In both cases the diffusion of hæmoglobin is hindered by NaCl and KNO_3 , while the salts of the alkaline earths have a decided neutralizing effect in all dilutions. Alexins, just as NH_4Cl , cause globulolysis by increasing in a marked degree the affinity for water of the stroma of the corpuscles which they impregnate. The antibody in immune serum increases the power of the corpuscles to absorb alexin, acting after the manner of a mordant.

Nolf's research leads to the conclusions that chemical hæmolytins act by causing hydration of the stroma, which then permits hæmoglobin to diffuse; that alexins are not proteolytic ferments, but act in the same manner as chemical agents, and that the antibody fixes the alexins to the corpuscles.

¹ Deetjen's observations (Virchow's Archiv, 1901, clxv., 232-289) indicate that the red corpuscles are surrounded by an elastic, transparent, homogeneous membrane.

It seems to me that there is much in Nolf's work on the mechanism of globulolysis that is applicable also to bacteriolysis, and that further studies along the lines he has indicated might give results that would tend to make still clearer the various phenomena observed in hæmolysis and bacteriolysis—phenomena that are now explained by the assumption of a number of distinct bodies of unknown nature (immune body, complement, etc.).

Hæmolysis and Bacteriolysis in Relation to Immunity. The principles underlying hæmolysis and bacteriolysis by serums, natural and immune, seem to be identical. This is emphasized by Bulloch.¹

In immunization with animal cells and bacteria certain bodies are said to form, and a number of terms have been introduced by the various investigators in order to conveniently express the intricate changes that result. As long as we are not acquainted with the essential nature of the phenomena, certain arbitrary terms must be used to represent the factors at work. Fortunately, there is a substantial unanimity among the investigators as to the mechanism of bacteriolysis and hæmolysis by serums. All seem to agree that in the familiar instances of bacteriolysis and hæmolysis two factors are at work—the specific immune body and the non-specific complement. The immune body is regarded as the link that binds the complement or ferment to the cell, bacterial or animal; hence it has been called by Bordet the sensibilisatrice, by Metchnikoff the fixator, by P. Müller the copula, and by London the desmon. Bordet and Nolf² believe that the immune body so modifies the corpuscles or bacterial cell that it directly absorbs the complement, *i. e.*, acts as a mordant. And this view is supported by Buchner,³ who denies that there is any proof of the special affinity claimed by the Ehrlich school to exist between immune body and alexin. Ehrlich and his pupils hold that the immune body has two haptophoric groups of molecules, one with affinity for the cell in question, the cytophile group; and another, with especial affinity for the complement, the complementophile group; for this reason they have in some of their later articles called the immune body amboceptor, regarding it as a sort of clamp. The unstable, non-specific ferment-like complement or alexin is termed cytase by Metchnikoff in some of his recent articles. In the English language the terminology of the Ehrlich school seems to have the upper hand at present, immune body being used as yet in place of amboceptor.

According to Ehrlich's lateral chain theory, antitoxins are molecular groups loosened from the cells and provided with a more or less well-

¹ Centralbl. f. Bakteriolog., Abth. I., 1901, 724-732.

² Ann. de l'Institut Pasteur, 1901, xv., 303-318.

³ Berl. klin. Wochenschrift, 1901, xxxviii., 854-857.

marked affinity for certain toxins, which are thereby prevented from uniting with the cells for which they are poisonous. Antitoxins have no influence on bacteria, but only on toxins, and antitoxic immunity must be carefully distinguished from bacterial immunity. Antitoxic therapy is a struggle between cells and toxins on the one hand, and between toxins and antitoxins on the other; and its ultimate object is to provide antitoxins with the greatest possible affinity for toxins—an affinity stronger by far than the affinity of the toxins for the cells.

Bacterial Immunity. In bacterial immunity living bacteria are destroyed without necessarily affecting the toxins. Bacterial immunity may be natural or it may be acquired. While the substance or substances called complements, alexins, etc., have no effect on antitoxic serum, they have long been regarded as essential factors in natural bacterial immunity, and Wassermann undertakes to demonstrate that such is the case by means of serum containing anticomplements. The fresh serum of guinea-pigs is normally hæmolytic for the red corpuscles of the rabbit. Repeated injections of rabbits produces antibodies which protect the red cells of this animal against hæmolysis by fresh guinea-pig serum. The intraperitoneal injection of typhoid bacilli mixed with 3 c.c. of this antiserum causes prompt death of the guinea-pig, while similar injections alone or mixed with the heated normal serum of rabbits do not cause the death of guinea-pigs. Similar results were obtained in experiments of the same kind with *staphylococcus pyogenes aureus*. Hence Wassermann concludes the anticomplements lower the natural resistance of guinea-pigs because they suspend the action of the complements in their blood. He does not claim, however, that all instances of natural immunity depend upon this mechanism because similar experiments with other non-pathogenic microbes gave no such positive results. But Besredka and others explain the results differently. Examination of the peritoneal fluid in the guinea-pigs injected with typhoid bacilli, as in Wassermann's experiments, shows that in those that survive there is marked phagocytosis, which is absent in those that die. Besredka claims that the anticomplement serum produces, when mixed with guinea-pig serum, a precipitate which imprisons leucocytes and paralyzes their phagocytic activity. It also has a direct agglutinating effect upon the leucocytes. Hence immunity and the loss of immunity in this case must still be explained according to the laws of phagocytosis. Wassermann further found that animals immunized against typhoid bacilli also lose their immunity under anticomplement.

Besredka¹ also combats Wassermann's² contention that the small degree

¹ Ann. de l'Institut Pasteur, 1901, xv., 209-231.

² Deutsch. med. Wochenschrift, 1900, xxvi., 285-287, and 1901, xxvii., 4-6.

of success of bactericidal typhoid serum is because it contains insufficient complement, and that in order to remedy this defect more complement should be added to the immune serum. By adding normal ox serum to typhoid serum Wassermann protected animals against an otherwise fatal dose of typhoid bacilli. Is this the result of the complement? Apparently not, because the ox serum does not lose its power after heating. Heated serum, whose complement consequently has been destroyed, injected into the abdominal cavity twenty-four hours before the bacteria may save guinea-pigs from twice the fatal dose of comma bacilli or typhoid bacilli. Metchnikoff and his pupils attribute this partly to the stimulation of phagocytes (liberation of complements), partly to the agglutination by the serum of the bacteria, which are thus more easily destroyed. They further suggest that heated ox serum may be used with advantage to bathe the peritoneum in operations on the abdominal cavity. In this connection it is interesting to note that Meltzer could not destroy by heating to 55° C. the hæmolytic power of ox serum on the corpuscles of rabbits, indicating that in this particular case there may be complements, or substances taking their place, which resist the degree of heat ordinarily destructive of complements—thermostabile complements.

Neisser and Wechsberg¹ determined that a certain amount of immune serum is necessary to kill a certain amount of bacteria. When a large amount of serum is used there may be no bactericidal effect. This apparent paradoxical effect they explain in the terms of Ehrlich's lateral chain theory of immunity: The immune body and the complement are necessary for bacteriolysis; the immune body has two chains of affinity; with one it is attached to the bacterium, with the other to the complement; if there is an excess of immune body it takes up the complement and keeps it away from the bacteria.

Wilde² shows that rabbits treated with an antiserum produced by injecting dogs with rabbit's normal serum succumb to doses of anthrax bacilli harmless for normal control animals; hence protective substances play a decided rôle in anthrax infection of rabbits.

While Bordet³ and others of the French school hold to the unity of the complements in the same serum, Ehrlich, Wassermann, and Neisser⁴ present experiments which favor strongly the multiplicity of complements with different receptors, which fact, in turn, corresponds with the various complementophile receptors of homologous groups of

¹ Münchener med. Wochenschrift, 1901, xxxviii. and xlvi., 697-700.

² Zeitschrift f. Hygiene u. Infektionsk., 1901, xxxvii., 476-496.

³ Bordet and Gengou: Ann. de l'Institut Pasteur, 1901, xv., 289-302. Bordet: Ibid., 303-318.

⁴ Deutsch. med. Wochenschrift, 1900, xxvi., 790-792.

immune bodies. Certain kinds seem common to most mammals so far studied (Wassermann). Ehrlich has obtained anticomplements active against many complements. Hence it is indeed an important matter in immunization to secure sufficient variety and numbers of complements if the complements normally present do not fully answer the purpose. Various methods have been suggested for this purpose. Numerous non-specific substances, such as salt solution, urine, bouillon, blood serum, nuclein solutions, cause when injected local or perhaps even general increase of complements.

Most of the work upon the source of the body or bodies variously termed alexin (Buchner), complements (Ehrlich), cytase (Metchnikoff) has been in the nature of experiments outside of the body. Thus Gengou¹ reaches the conclusion, from testing the bactericidal effect of extracts of leucocytes made by freezing, and of blood serum deprived as much as possible of leucocytes, that the polymorphonuclear leucocytes constitute the principal source of complement in normal serums. Metchnikoff, Bordet, and others have reached similar conclusions. Wassermann² attacked this problem in another manner, namely, by injecting guinea-pigs with the rabbit's leucocytes freed as thoroughly as possible from serum. The guinea-pig developed a distinct anti-complement, which could be tested in the usual manner, thus showing conclusively that leucocytes must be a source of complements. But Wassermann would not claim that the leucocytes are the only source of complements.

Donath and Landsteiner,³ and Ascoli and Riva⁴ reach similar conclusions from experiments along the same lines.

The following quotation from Ehrlich's Croonian Lectures for 1900 represents his views as to the importance of complements in immunity: "It appears that in the therapeutic application of antibacterial sera to man therapeutical success is only to be attained if we use either a bacteriolysin with a 'complement' which is stable in man ('hæmostabile complement'), or at least a bacteriolysin, the 'immune body' of which finds in human serum an appropriate 'complement.' The latter condition will be the more readily fulfilled the nearer the species employed in the immunization process is to man. Perhaps the non-success which as yet has attended the employment of typhoid and cholera serum will be converted into the contrary if the serum be derived from apes and not taken from species so distantly removed from man as the horse, goat, or dog. However this may be, the question of the pro-

¹ Ann. de l'Institut Pasteur, 1901, xv., 68-84 and 232-248.

² Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvii., 173-204.

³ Wien. klin. Wochenschrift, 1901, xiv., 713, 714.

⁴ Münchener med. Wochenschrift, 1901, xlviii, 1343-1345.

vision of the appropriate 'complement' will come more and more into the foreground, for it really represents the centre around which the practical advancement of bacterial immunity must turn."¹

According to Ehrlich's theory, the immune body ("receptor of the third order") is thrown off from the cells into the blood of the immunized animal. In the case of hæmolysis the immune body has greater affinity for the proper red corpuscles than for the complement, and this fact is made use of in experiments in which the corpuscles are allowed to bind or absorb the immune body at a low temperature before union with the complement may take place. These "absorption" experiments are exceedingly useful for separating the immune body and its complements and subjecting them to various tests. Ehrlich and Morgenroth² have succeeded by experiments of this kind in demonstrating that the serum of rabbits immunized with ox blood or goat's blood contains immune bodies whose haptophoric groups fit the receptors of more than one kind of red cell. The serum of the animals treated with ox blood contained at least two immune bodies, of which one acts only on the corpuscles of the ox, while the other acts on the corpuscles of the goat. This shows that the idea of absolute specificness hitherto attached to the immune body must be modified to a considerable extent. The serum of rabbits immunized by injections of ox blood contains immune bodies. The repeated injection of the serum of such rabbits into goats, for example, produces anti-immune bodies (anti-amboceptors), which prevent the union of immune body and complement, and thus suspend hæmolysis. By means of ingenious experiments Ehrlich and Morgenroth show that just as there are different immune bodies in immune serum so there are also a variety of anti-immune bodies, and their general conclusion is therefore that hæmolytic and bactericidal serums contain many groups of immune bodies with different cytophile receptors. In order to secure prompt destruction of bacteria, bactericidal serums should contain the largest possible number and variety of immune bodies, and they recommend mixtures of immune sera, in order to secure cytophile receptors to fit the corresponding receptors on the bacterial cells. The plural nature of the receptors of immune bodies and complements, made clear by the experiments of Ehrlich and Morgenroth, Wassermann and others, represents perhaps the most important recent advances in the doctrines of immunity of the Ehrlich school.

Buchner³ still insists that the essential factor in hæmolysis and bacteriolysis is the alexin, meaning thereby the ferment-like substance so

¹ Croonian Lectures, Proceedings of Royal Society, 1900, lxvi.

² Berl. klin. Wochenschrift, 1901, xxxviii., 569-574 and 598-604.

³ Ibid., 854-857.

named by him long ago, and that the most the so-called immune body does is to favor the action of the alexin ("Hülfkörper").

London¹ regards the union between the immune body (desmon) and alexin as a chemical one, because they act in definite proportions. He finds that the normal blood contains various hæmolysins (immune body and complement), the immune body in animals experimented upon differing from the physiological in giving strong hæmolysin with a weaker alexin. The formation of hæmolysins in immunized animals is referred by London to the cells of the spleen.

In recurrent fever Sawtchenko and Melkich² trace the immune body to intracellular digestion of the spirilla. In immune serum outside of the body, and also in the peritoneal cavity of immunized animals, the spirilla perish, as in Pfeiffer's phenomenon, by the combined action of immune body and alexin. The action of alexin is necessary for extra-cellular destruction.

Richardson's interesting observations on bacteriolysis in typhoid fever and Durham's explanation of the relapses in fevers seem to me to harmonize fairly well with Ehrlich's recent enlargement of the theory of cytolysis (multiplicity of immune body and complement).

Richardson³ investigated the bacteriolytic action of the serum of forty-one typhoids at various stages, alone, in combination with normal serums and with serums of persons with diseases other than typhoid. As ordinarily applied, typhoid serum alone, as a rule, had no destructive effect, but when mixed with normal serum quickly destroyed the bacilli, though not in all cases. This discrepancy was found to depend on the order in which the ingredients of the mixture were combined. If normal serum and typhoid serum were mixed before the bacilli were added there was no destruction; but the order of bacillus, typhoid serum, and normal serum or bacillus, normal serum and typhoid serum gave good results. This reaction was not found to be specific, however, because the serum of a case of pneumonia mixed with normal serum and the mixture of two normal serums caused digestion of the bacilli when combined in the order mentioned. Even the mixing of serum from a normal individual, one sample fresh and one old, and also both fresh, often produced marked destruction. Here also the order was found to be essential. These last experiments would indicate the presence, in small quantities perhaps, of protective substances in normal blood. Acute infections seem to destroy this power of normal serum for the time being, but it may also disappear without any special cause being apparent, showing that the normal protective substances are

¹ Arch. d. Sc. biol., 1901, viii., 285-325.

² Ann. de l'Institut Pasteur, 1901, xv., 496-526.

³ Journal of Medical Research, 1901, vi., 187-200.

very unstable. It was found that in the middle of typhoid fever and in relapses the blood serum seems to lack the normal element, but as convalescence sets in the mixture of two samples of the same serum destroyed the bacilli. Normal serum seems to be indicated in the treatment of the disease at its height, but whether the order in which the various factors now would meet is an efficient one has not been investigated.

In certain fevers—*e. g.*, typhoid—antibacterial substances develop in the blood, and relapses are therefore somewhat paradoxical. Herbert E. Durham¹ suggests that relapses are explainable on the score that the attacks may depend on the preponderance of varietal forms, each capable of causing more or less specific antibodies, which, however, do not protect against all varieties and subvarieties of the same organism. This refinement of bacterial variability is supported by the observations of Pfeiffer and Kolle, that the protective power of typhoid serum varies with different cultures; agglutination with different serums and strains of bacilli also show marked variations. Durham found a culture of *B. enteridis* (Gärtner) which differed much in respect to agglutination from other cultures of the same bacillus isolated in the same epidemic of meat poisoning; and van der Velde's researches on streptococcal serum showed that it may be destructive for some forms of streptococci, but not for others, thus favoring Durham's view applied to the well-known tendency of erysipelas to recur.

Durham² advances a view in regard to bacterial agglutinins which is similar to the Ehrlich-Morgenroth conception of the multiplicity of immune bodies. He assumes that the bacterial bodies contain a variety of components which may give rise to a corresponding number of agglutinins, the agglutinins hitherto regarded as single being in reality multiple. In this way he would explain the varying degrees of agglutination of different strains of typhoid bacilli and the agglutination of specific sera of closely related bacteria.

Regeneration of Complements. Albert Schütze and Robert Scheller,³ having determined the solvent action of rabbit's serum upon the corpuscles of the goat, injected into rabbits as much goat's blood-corpuscles as was calculated to bind all the hæmolysin present in the rabbit's serum. In this way they demonstrated that within fifteen minutes after injecting the red blood cells of the goat all the globulicidal substance of the rabbit's blood was used up. In order to show that this result depended upon the using up of complement, and not merely of immune body, they added the serum of the injected rabbits to inac-

¹ Journal of Pathology and Bacteriology, 1901, vii., 241-249.

² Journal of Experimental Medicine, 1901, v., 353-389.

³ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvi., 459-464.

tivated rabbit's serum, but found that no reactivation followed, as would be the case were complement present in the serum of animals treated with goat's blood. It was found that complete regeneration of the globulicidal substances may take place in from two to four hours, subject to considerable individual variation. In addition to the formation of antibodies, the regeneration of complements constitutes an essential measure in immunity. In experimental infections with the bacillus of hog-cholera the regeneration of complements as tested by the injection of goat's serum is materially delayed, at times absent. This demonstration may contain the explanation of the great danger of secondary infections.

Ostranine¹ did not find any diminution of the general bactericidal action of the serum of rabbits and of guinea-pigs during infection with *B. anthracis* and *cholera vibrios*, respectively. This, I would suggest, may be explained in part on the score of regeneration; in part as dependent on the multiplicity of the complements.

Is the Bactericidal Action of Normal Serum due to Starvation and Osmotic Disturbances? In *PROGRESSIVE MEDICINE* for March, 1901, pages 301 to 304, I briefly reviewed the observations upon which Baumgarten and his pupils and Fischer base their objections to the theory that bactericidal action of normal blood serums depends upon the presence of fermentative substances of the nature of Buchner's alexin. In the following are given brief abstracts of more recent articles embodying the results of experimental investigations upon this problem.

von Lingelsheim² investigated the relations of salts to the bactericidal action of serum. He points out that death of bacteria in solutions and substances containing salts may be referred wholly to disturbances in osmotic pressure only when the composition of the media used is known fully, because if there are any specially deleterious substances present the real cause of death may not be osmotic changes, but the result of the noxious effect of such substances. This remark is especially applicable to blood serum whose real composition is not known—lysins and other deleterious substances are not unlikely to be present. In investigating the bactericidal action of purely osmotic factors, agar growths of various bacteria were suspended in 2 c.c. of 0.67 per cent. NaCl solution, and the action of pure salt solutions of various concentrations tested by means of the plate method. The results show that the concentration of 0.5 to 0.75 per cent. NaCl is best tolerated; in fluids of less or greater concentration more or less destruction of bacteria takes place.

¹ Ann. de l'Institut Pasteur, 1901, xv., 266-278.

² Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvii., 131-172.

Dialyzed blood serum was found to be a strongly bactericidal agent due apparently to the alkalies present. He then compared the bactericidal influence of serums of various animals with that of 0.92 per cent. NaCl solution, and found that when considerable material is used for inoculation the serum has much greater bactericidal action than the salt solution. In spite of the addition of increased amount of salt to serum the destructive action actually diminishes, the bactericidal effect being restored by again diluting the serum, which is directly contradictory to those opinions which hold that the bactericidal action is the result of high osmotic pressure and unfavorable nutritive character of serum. The addition of increasing amounts of NaCl to serum showed that in many cases complete suspension of bactericidal effect soon results, the salts diminishing the fermentative action, as in the case of other ferments, in the presence of excessive quantities of salts. Buchner has shown that removal by dialysis of salts suspends the action of alexin, which is restored on adding corresponding quantities of salt, and, furthermore, that a certain quantity of salt protects alexin against destruction by heat, which Biernacki and others have found is the case in other ferments. von Lingelsheim thus completes the analogy between ferments and alexin by showing that when a certain optimum quantity of salt is exceeded the bactericidal action is suspended. Potassium nitrate has but little effect; calcium chloride, ammonium sulphate, and magnesium sulphate were more active. Ferric sulphate, alum, and tannin all caused marked diminution of bactericidal action of rabbit's serum on anthrax bacilli.¹ von Lingelsheim also found that reaction plays an important part. In non-nutritive salt solutions slight alkalescence increases bactericidal action, but not in serum when concentration of salts is brought about. Here are also analogies with other ferments—pepsin withstands heat best in acid, trypsin in alkaline reaction. Hence the bactericidal action of serum may be diminished by a variety of manipulations which do not suspend osmotic variations (but actually increase them) or decrease the amount of food-supply. The results harmonize best with the presence in serum of a ferment which attacks bacteria.

von Lingelsheim answers the question How do peptone and other nutritive substances suspend bactericidal action, by suggesting that they probably favor weakened bacteria by rendering it unnecessary for the bacteria to manufacture proteolytic enzymes. While the bactericidal action of normal serum is not explainable on an osmotic basis, it does not at all follow that osmotic disturbances should be left out of all

¹ For the varying action of salts on ferments of various kinds, see Nasse, Pfüger's Archiv, xi., quoted by von Lingelsheim.

consideration in the estimation of the action of various substances on bacteria.

Emmerich, Tsuboi, and Steinmentz¹ long ago showed that bactericidal action of serum heated to 55° C. is restored by adding highly diluted alkali.

Hegeler² also investigated the causes of the bactericidal action of serum. He cultivated bacteria (*B. typhosus*) upon heated, inactive serum, and then he added active serum, and studied the result by means of the plate method. Plasmolysis did not take place, and great reduction in the number of colonies resulted. The addition of 1 per cent. salt solution had no such effect. When the suspensions were kept in constant motion so as to prevent sedimentation the addition of active serum killed nearly all bacilli. Hence he concludes that serum contains alexin—*i. e.*, a direct bactericidal substance.

Trommsdorff³ reached similar conclusions.

Klimoff⁴ studied the bactericidal action of normal rabbit's serum under circumstances planned to prevent plasmolysis of the bacteria, which, according to Baumgarten, is the chief factor in the bactericidal action of serums in experiments of this kind in which bacteria are transferred from one medium to another of different concentration. Klimoff carried out his experiments upon Löffler's serum from which bacteria (anthrax and typhoid bacilli) were transferred to unheated and to heated serum for a few hours and then sown on serum plates. Unheated serum was found to possess distinct bactericidal qualities.

AGGLUTINATION.

Mechanism of Agglutination. By covering lucifer matches with hard soap and throwing them into a trough half-filled with water colored blue with litmus, and then adding a little acid, Brunton⁵ demonstrated that the matches at once draw together in clumps. If a solution of caustic potash is poured in the clumps will not re-form when broken up. Disks of cork, loaded at one side with shot so as to float upright in water, may be used to imitate the formation of rouleaux of blood-corpuscles. If partially submerged they quickly run together, as shown by Norris, in 1869; if dipped in petroleum they run together even when submerged. And Brunton shows that these cork disks form rouleaux when coated with soap and thrown into acidu-

¹ Centralbl. f. Bakteriöl., 1892, xii., 365 and 450; xiii., 576.

² Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvii., 115-119.

³ Arch. f. Hygiene, xxxix., 31.

⁴ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvi., 120-130.

⁵ Journal of Pathology and Bacteriology, 1900, vii., 53, 54.

lated water; hence rouleaux formation and bacterial clumping are probably due to alterations in surface tension. It is suggested by Brunton that this may be due to some fatty substance formed by carbonic acid.

The influence of salts in agglutination has been much neglected heretofore. A. Joos,¹ in his recent study of the mechanism of agglutination of bacteria, came to the conclusion that sodium chloride is an essential and an active factor in its occurrence. He shows this by removing the salts from the serum and from the suspension of typhoid bacilli by means of dialysis. Agglutination then fails to take place when serum and bacilli are brought together in proper proportions, but when a little salt is added characteristic flocculi form. When typhoid emulsion free from salt is mixed with agglutinating serum also free from salt and filtered, agglutination does not occur when typhoid bacilli and normal salt solution are added to the filtrate; hence the agglutinating substance must have been fixed by the bacterial cells. If a mixture of salt-free serum and bacillary emulsion is centrifugalized and the fluid carefully removed agglutination occurs on adding the bacilli to the salt solution, but the fluid mixed with salt and bacilli does not cause agglutination. Agglutinating and agglutinizable substances thus have close affinity for each other, and the amount of salt necessary in order that complete precipitation and agglutination may take place is quite definite.

The salt is in a measure taken up by the bacilli and also by the agglutinating substance.

Friedberger² corroborates Joos' statement in regard to the rôle of sodium chloride, but extends the observations so as to show that agglutination fails to occur in the absence of crystalloid substances in general in the fluids. Of the substances examined by Friedberger the inorganic salts are the most active, though in varying degrees. In dialyzed cultures the rapidity of the agglutination is dependent on the salt content in the fluid suspension; in the case of a bacterial emulsion the rapidity depends on sodium chloride. The mode of action of salt is not determined.

F. C. Harrison³ claims that the agglutinating substance exists in the outer layers of the bacilli. When the external layers are dissolved the remaining portion is not agglutinated by strong serum.

McCrae⁴ shows that agglutinative properties develop in the blood following the insertion into the abdominal cavity of bacilli enclosed in

¹ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvi., 422-439.

² Centralbl. f. Bakteriöl., Abth. I., 1901, xxx., 336-346.

³ Ibid., 115-118.

⁴ Journal of Experimental Medicine, 1901, vi., 635-642.

celloidin capsules. (He describes an improved method of preparing such capsules.) In this case agglutinin results from the reaction to the diffusible chemical products of the bacilli or a combination of the serum with these products. Removal of the capsules filled with bacilli is succeeded by a steady fall in the agglutinating property of the serum. This observation is taken to indicate that the persistence of the serum reaction for months and even years in some cases after typhoid means the presence somewhere of living bacilli—*e. g.*, in the gall-bladder, the urine, which elaborate the necessary substances for the production of agglutinins.

Experiments of Rehns¹ and Nicolle and Trenel² show that dead cultures of typhoid bacilli agglutinated by serum produce in animals an agglutinating power in no way different from that of animals inoculated with non-agglutinated bacilli.

Castellani³ has studied the question of the relation of agglutinins to protective bodies. He, as others before him, found that these two groups of substances respond in the same manner to a certain number of chemical and physical factors; but in my opinion the experiments have not been carried far enough to throw much light upon their composition. In immunized animals the serum is at first richer in agglutinin, whereas the spleen is richer in protective(?) substances. The serum loses the agglutinating power earlier. Agglutinins may develop after immunization, but no anti-infectious substances. From these results it would seem that the opinion of Jatta and others, that there is a very close relation between agglutinating and bactericidal substances, is not correct—agglutination is not a reaction of immunity.

Kraus⁴ demonstrates that where there is specific agglutination there is specific precipitation—*i. e.*, germ-free filtrates form precipitates with homologous serums in the cases where the bacteria are agglutinated. Specific precipitates are consequently of the same diagnostic value as agglutination.

GENERAL BACTERIOLOGY.

Bacterial Enzymes. Eijkman⁵ presents a study of certain enzymes of bacterial and fungal origin, using the auxanographic method. He shows that these enzymes, as well as others of animal origin, are dif-

¹ Comp.-rend. de Soc. biol., 1900, lii., 1058, 1059.

² Ibid., 1088, 1089.

³ Zeitschrift f. Hygiene u. Infektionskr., 1091, xxxvii., 381-392.

⁴ Centralbl. f. Bakteriol., Abth. I., 1901, xxx., 378-379. Abstr. from Wien. klin. Wochenschrift, 1901, xiv., 693-695.

⁵ Centralbl. f. Bakteriol., Abth. I., 1901, xxix., 841-848.

fused throughout the agar ; this is easily demonstrated by incorporating certain substances, such as starch, and then placing a drop of, say, saliva upon the surface. Indeed, from this result it seems not unlikely that colloidal substances are diffusible, contrary to current opinion. By means of milk agar, Eijkman finds that certain bacteria—*e. g.*, *B. anthracis*, *B. pyocyaneus*, *staphylococcus pyogenes aureus*—produce enzymes that split up casein, as shown by the development of a clear space about the culture. Hæmolytic enzymes were studied by means of agar intimately mixed with blood, colonies of bacteria (such as the comma bacillus, *B. anthracis*) which produce a hæmolytic ferment soon being surrounded by a clear space. In starch agar certain bacteria were found to change the starch. Lipase is also produced by some bacteria (*B. pyocyaneus*, *staphylococcus pyogenes aureus*, *B. prodigiosus*), and in a Petrie dish the fat covered with agar may be saponified.

Cacace¹ has subjected the proteolytic function of a number of bacteria to careful study, the results of which indicate that proteolysis is of the same nature in all living organisms.

The Production of Acids by Bacteria. The work of Libman² on the precipitation of albumin by acids of bacteria produced in the presence of glucose brings to the fore the question of acid production by pathogenic bacteria. In a recent article giving some of the details of his experiments, Libman³ concludes that it is necessary now to determine whether acids are produced in infectious diseases, and also to ascertain their effects on the blood, their possible rôle in thrombosis, etc. Theoretically there is good reason to believe that acids may be formed in the tissues by bacterial action.

The Influence of the Amount of Salt in the Medium upon the Growth Form of Micro-organisms. Matzuschita⁴ studied this question in regard to a number of organisms. The influence of salt added to nutrient agar varies in the case of different microbes. Some microbes grow quite as usual even when as much as 10 per cent. of salt is added, while others present marked degenerative phenomena when much less salt is added. Thus the bacillus of pest forms large, round, globular—vesicular degeneration forms—and other curious shapes on 2.5 to 3.5 per cent. salt agar ; these forms are so pronounced and so characteristic that they may be used in the diagnosis of the pest bacillus. *B. pyocyaneus*, *B. acidi lacti*, *B. anthracis*, and other bacilli form similar balls, but not nearly in such numbers and so rapidly as *B. pestis*.

¹ Centralbl. f. Bakteriöl., Abth. I., 1901, xxx., 244-248.

² PROGRESSIVE MEDICINE, March, 1900, p. 315.

³ Journal of Medical Research, 1901, vi., 84-96.

⁴ Zeitschrift f. Hygiene u. Infektionskr., 1900, xxxv., 495-510.

Structure of Bacteria. Nakanishi¹ has done important work on the structure of bacteria, demonstrating, as he claims, by means of staining fresh bacteria with methylene blue dissolved in plasma, that bacteria have a typical cellular structure, including nucleus, cytoplasm, and in some cases a more or less distinct membrane. Spore formation is interpreted as an intracellular encapsulation of the nucleus and the condensed perinuclear cytoplasm.

Branching of Bacteria. Arthur Meyer² discusses the branching of bacteria from the botanical stand-point. He points out that true branching is observed in all kinds of bacteria (non-sporogenic, sporogenic) and spirilla, and describes in detail the branching of a sporogenic bacillus, *bacillus cohærens*. The general conclusion is: The species of bacillus and bacterium have inherited from their forefathers (fungi with branching threads) the faculty of branching; this, however, occurs only rarely and in rudimentary fashion. It takes place most typically in the early stages of development—a stage which probably corresponds to the formation of branching mycelium in the ascendants. This faculty of branching being quite general among bacteria, there seems to be no special reason for regarding tubercle bacillus and diphtheria bacillus otherwise than as normal species of bacterium.

Reichenbach,³ referring to the notion of Brefeld, Gamaleia, and others that bacteria may be developmental stages—oidial forms—of higher fungi, points out that the presence of branching in bacteria may be regarded as the most favorable evidence as yet adduced in favor of this view. He then describes the presence of true branches in spirillum rubrum. Branching forms develop readily in the deposit at the bottom of bouillon cultures a few days old. Because the branches do not form spirals, Reichenbach is inclined to doubt their being real branches. The question is left open. Bergey,⁴ reviewing recent work in bacteriology, inclines to the opinion that the so-called branches of bacteria are merely sprouts from the polar granules of Ernst, which Marx and Woithe hold are a specialized form of bacterial protoplasm.

Artificial Modifications of Toxins. James Ritchie⁵ shows that acids and alkalies have an important effect in modifying the toxicity of certain toxins, which then may be classed with Ehrlich's toxoids, as they are less toxic than the original poisons, but have the power of producing immunity. The experiments were made with tetanus toxin, ricin, abrin, and diphtheria toxin. Tetanus toxin loses virulence under the influence of hydrochloric acid and alkalies, such as sodium hydrate and sodium

¹ Centralbl. f. Bakteriöl., Abth. I., 1901, xxx., 97-110, 145-158, 193-201, 225-232.

² Ibid., 49-60.

³ Ibid., xxix., 553-557.

⁴ Medicine, 1901, vii., 618-622.

⁵ Journal of Hygiene, 1901, i., 124-144.

carbonate, while diphtheria toxin is resistant to hydrochloric acid, but susceptible to sodium hydrate. It would be interesting to study the action of the different ions on toxins.

Baldwin and Levene¹ report upon some studies of the action of proteolytic enzymes on diphtheria and tetanus toxins and on tuberculin. They show that diphtheria and tetanus toxins are digested by pepsin, trypsin, and papain, and not merely neutralized. Tuberculin is more easily destroyed by trypsin than by pepsin, from which they draw the conclusion that tuberculin is a specific substance of the nature of nucleo-proteid, because nucleo-compounds in general are more resistant to peptic digestion. This work indicates that the diphtheria and tetanus toxins are of proteid nature.

Sigwart² shows that pepsin and trypsin, without the conjoint action of free acid, have no bactericidal influence, as they are incapable of digesting anthrax bacilli that are under favorable conditions. He points out that it is consequently not warranted to compare the alexins of Buchner with "proteolytic ferments," as is done so frequently, because the alexins are supposed to exercise their action in the blood-serum, which is an alkaline fluid in which the ordinary proteolytic ferments have not the power to destroy bacteria.

From interesting investigations of Cooley and Vaughan³ it may be concluded that the toxin within the cells of the colon bacilli does not diffuse into the culture medium under ordinary circumstances; it is not extracted by either alcohol or ether, nor by dilute alkalies; the germ substance may be heated in water to a high temperature without destroying the toxin, and but little effect results from boiling with 0.2 per cent. solution of hydrochloric acid, while heating for hours on the water-bath lessens but does not destroy the toxicity of cell contents. The toxin is best separated by digestion with hydrochloric acid and pepsin, and is very active and remarkably stable; it may be retained permanently in a dry state. Hence it would seem to offer good opportunity to ascertain the chemical constitution of at least this form of bacterial toxin. Many questions of importance—as, for instance, the mode of liberation of the toxin in the animal body, its exact chemistry and composition—remain unanswered.

Bacteria in the Intestinal Tract. Kohlbrügge reviews the literature bearing upon the bacteria in the intestines,⁴ and publishes also the results of his own observations.⁵ In animals the stomach and the small

¹ Journal of Medical Research, 1901, vi., 120-135.

² Arbeit. aus path. Anat. Institut zu Tübingen, 1901, iii., 277-292.

³ Journal of the American Medical Association, 1901, xxxvi, 479-482.

⁴ Centralbl. f. Bakteriöl., Abth. I., 1901, xxx., 10-26.

⁵ Ibid., xxix., 571-574.

intestine undergo a process of autosterilization at the same time that they are emptied of their usual contents. But he never found the cæcum or the colon sterile, the bacterium coli being the prevailing form, and hence he regards the cæcum as the special breeding-place of those bacilli that are common to the individual and persist throughout life. The vermiform appendix, being free from such violent peristalsis as the cæcum, may be the particular place which secures the permanence and stability of our intestinal bacteria, which no doubt influence digestion favorably and protect from foreign bacterial invasion. Kohlbrügge shows more respect for the physiological importance of the vermiform appendix than is general at the present time. Metchnikoff¹ discusses the same question and lays special stress on the (in his opinion) absolute harmfulness and danger of the large intestine in man. The large intestine shelters forty-five of the sixty to seventy different kinds of microbes of the human body, and thus it becomes the most important source of auto-intoxication, because most of the bacteria produce toxic substances. The poisons that render us old before our time come principally from this source, he says. Now the large intestine cannot be sterilized. We cannot follow the examples of the birds, which evacuate their intestinal contents as soon as digestion is finished. Metchnikoff points out that the longest-lived vertebrates are those with the shortest large intestine, which therefore is not at all essential to life in man. Still it is not likely that surgeons may be persuaded to remove this source of evil, and as we have no means of immunizing against our indigenous intestinal flora, Metchnikoff recommends small doses of the different cytotoxins to counteract the evil influences of the large intestine upon the cells.

Bail² introduced 5 c.c. to 6 c.c. of bouillon suspension of highly virulent streptococci directly into the stomach of rabbits, great care being exercised not to infect the pharynx. In a few of the animals a general streptococcus infection followed, the cocci making their way through the intact wall of the small intestine into the vessels of the mesentery. Hence, Bail concludes that a general infection may result from the passage through the normal intestinal wall of virulent streptococci.

Relation of Bacteriology to Clinical Medicine. Petruschky³ points out that the recognition of the clinical picture of an infectious disease is not always sufficient for the diagnosis, because the same clinical picture may be caused by different infecting agents, so that a careful bacteriological examination is essential for the scientific diagnosis of many infectious diseases. He cites numerous examples illustrating this

¹ Presse Médicale, 1901.

² Arch. f. klin. Chir., 1900, lxii., 389-384.

³ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvi., 151-160.

statement. Perhaps the most important disease that can be mentioned in this connection is typhoid fever. It took a long time before it was distinguished by clinical methods from other fevers, and even now miliary tuberculosis and various forms of meningitis and other infections are not readily differentiated from typhoid without careful bacteriological examination; and recently we are beginning to discover that the clinical symptoms and signs of typhoid fever may be caused by other bacteria than *B. typhosus*, namely, the so-called paratyphoid bacilli. Thus Schottmüller,¹ in a series of sixty-eight cases of suspected typhoid, encountered five whose blood contained paratyphoid bacilli.

For years it has been taught that typhoid fever has a pathological anatomy so characteristic as to be pathognomonic, but recently we have had occasion to learn that typhoid fever may exist without any of the usual gross anatomical lesions being present, the clinical picture depending upon a typhoid bacteriaemia only. In such cases the post-mortem diagnosis of typhoid fever cannot be made without careful bacteriological examinations. Again, the typhoid bacillus may be present for years in some part or other of the body—*e. g.*, the bile, the urine—without causing typhoid fever. The active cause of a disease may be present, but not the disease itself. This is illustrated also by *B. diphtheriæ*, *spirillum cholerae Asiaticæ*, and other pathogenic bacteria. These references recall the fact that the relations between disease and the cause thereof are not always as simple as apparent at first sight, the relations being greatly modified in various ways by the peculiarities of pathogenic organisms on one hand and the individual person on the other.

Neusser also takes occasion to emphasize the necessity and the importance of an actual and familiar knowledge of bacteriology in arriving at a correct diagnosis of many conditions; and Wyeth took as the subject for his address on surgery before the recent meeting of the American Medical Association at St. Paul the importance of bacteriological methods in clinical surgery.

It seems to me that the importance of basing the clinical diagnosis upon a definite etiological basis is self-evident. Physicians should aim at thinking on etiological lines, in order that the correct individuality of the different infections may be recognized adequately. This refinement in clinical diagnosis is achievable only when bacteriological and other laboratory methods of diagnosis are used as freely and as intelligently as the stethoscope and the thermometer.

Andrew H. Smith² urges that inflammation *per se* be no longer given such extensive and separate consideration as heretofore, because as

¹ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvi., 368, 369.

² Trans. Assoc. of Amer. Phys., 1900, xv.

long as we continue so to do it tends to obscure the exact relationship of cause and effect. The phenomena ordinarily designated as inflammatory should receive proper consideration in connection with the various morbid agents known to pathology. Were this done there would no longer be room for "inflammation," now usually discussed so exhaustively by itself in the various text-books. By studying the inflammatory processes from the etiological side more definite conceptions would be obtained, greater exactness secured, and therapeutic efforts would be directed toward removing the fundamental causes. From the stand-point of pathological histology I would urge that it should be remembered that the various inflammatory diseases and processes have so many and such essential characteristics in common that it is desirable to continue the old custom of endeavoring to secure an insight into the nature of the reactions to injury and local infection by presenting the subject of inflammation as a whole, due emphasis always being given to the cause.

Micrococcus Lanceolatus.¹ Neufeld² found that the pneumococcus may produce a typical erysipelas in the rabbit's ear. Indeed, various races of pneumococci seem to possess this quality more frequently than streptococci. Petruschky has shown that certain forms of *B. coli* also produce an erysipelatous inflammation of the rabbit's ear.

Williamson³ made a number of experiments on rabbits with a view of determining the relation of leucocytosis and its supposed defensive action in pneumonia. He finds that at first the leucocytes rise rapidly, but soon drop below the normal. The number of leucocytes varied considerably, and occasionally leucocytosis was absent. The degree of leucocytosis stands in no relation to the number of leucocytes present before inoculation. The short duration of leucocytosis is probably due to the virulence of the infective agent. So-called "agonal hyperleucocytosis" was never noted by him. He found no relation between the degree of leucocytosis and the clinical course and duration of the disease. Leucocytosis does not seem from the experiments to influence the course of the disease, and therefore the presence of greater or lesser numbers of leucocytes in the blood is not regarded by him to be an important factor as a protective measure in this disease. The pneumococcus may be found in the blood of rabbits from three to five hours after subcutaneous inoculation. At times they may again disappear from the blood. There is a distinct relation between the appearance of pneumococcal sepsis and hypoleucocytosis. After the pneumococci

¹ For an interesting discussion of the Pathology of Pneumococcus Infection, see A. G. R. Foulerton and others in *British Medical Journal*, 1901, ii., 760-766.

² *Zeitschrift f. Hygiene u. Infektionskr.*, 1901, xxxvi., 253-257.

³ *Ziegler's Beiträge*, 1901, xxix., 41-91.

break into the blood the leucocytic curve drops even below normal. Since the prognosis of fibrinous pneumonia in man is always unfavorable when the leucocytes are greatly reduced in number, Williamson explains this by the presence of the organism in the blood (sepsis) in great numbers, which causes the death of the animal or man.

Henke¹ discusses the relation of the pneumococcus to acute endocarditis, and more particularly the question whether pneumococcal endocarditis corresponds to a special anatomical form of endocarditis. This question has been considered by Netter, Weichselbaum, and Kirchsteiner, the latter regarding the following appearances as characteristic of pneumococcal endocarditis: extensive yellowish-green vegetations with broad base, smooth surface, and tendency to softening—a form midway between ulcerous and vegetative endocarditis. Henke describes three cases of pneumococcal endocarditis, in one of which the appearances just mentioned were present. In all there were numerous infarcts, but without suppuration; but, in general, definite and decisive appearances sufficient to establish this form of endocarditis upon a distinct anatomical basis were not established, and this is probably in accord with the general opinion. Various agents may produce similar endocardial lesions. That pneumococcus and other forms of acute endocarditis, even of the ulcerative type, may heal seems to be unquestioned. Netter observed an experimental pneumococcus infection of the endocardium subside, Traube reports a case of recovery, and Harbitz² classes this form among the clinically benign. I have recently seen three instances of healed perforation of an aortic valve which in each case shows a defect, with rounded margins and a diameter of 12 mm., located in the main part of the thickened curtain.

Binaghi, Howard and Perkins,³ and Richardson⁴ describe capsule-bearing organisms resembling pneumococci. Richardson observed them in four cases of lobar pneumonia in gray hepatization. They are regarded as secondary invaders. This coccus differs from the pneumococcus, especially in the persistence of the capsules in the cultures; it also forms larger colonies on serum, may appear as a mucus-like scum, and it grows luxuriantly on gelatin at the room temperature. Howard and Perkins name their organism *streptococcus mucosus*; it was isolated from a case of peritonitis and tubo-ovarian abscess; its growth is viscid, and it causes gelatinous exudations in animals.

Plague. The presence of bubonic plague in San Francisco has quickened greatly the interest in the disease among American physi-

¹ Virchow's Archiv, 1901, clxiii., 141-150.

² PROGRESSIVE MEDICINE, March, 1899.

³ Journal of Medical Research, 1901, vi., 163-174.

⁴ Journ. of Boston Soc. of Med. Sci., 1901, v., 499-505.

cians. The valuable work of the Federal Commission set out to investigate the plague in San Francisco is reviewed elsewhere. The various articles¹ of the members (Barker, Flexner, Novy) and their report² contain much of interest from the pathological side as well as for the clinician. The fact was emphasized in the San Francisco experience that the scientific diagnosis of bubonic plague rests upon the bacteriological examination, and that scientific accuracy and positiveness are essential under such circumstances as arise when plague is said to exist.

HISTOLOGY OF BUBONIC PLAGUE. The following is a summary from Flexner's³ report upon the pathology of plague:

In lymph glands the seat of the original invasion, hemorrhage and necrosis are the chief lesions; similar changes occur in the periglandular tissues also. The medullary and cortical regions become unrecognizable, and in the medulla all the structures undergo necrosis. The bloodvessels become thrombosed and their coats infiltrated with perishing leucocytes; the leucocytes also penetrate the outer zones of nerves in the periglandular tissue. In no other infectious disease are bacteria encountered in the tissues so abundantly as the bacilli in and about these lymph glands; they obstruct blood and lymph channels, swarm in the fluid exudate, and fill every available space.

In the lymph glands invaded secondarily the subcapsular sinuses contain large cells phagocytic for red blood cells. The lymphoid cells of the denser regions are increased in number, and the pale, central areas of the nodules enlarged; this with fragmentation of nuclei in these areas produce alterations quite analogous to those that have been noted in diphtheria and typhoid fever. Fibrin accumulates in and without the vessels in delicate strands.

A proliferation of cells in the pulp, and to a lesser extent of the lymphoid cells in the nodes, takes place in the spleen; the former cells are quite similar to Unna's plasma cells. The vessels of the spleen contain an excess of blood; macrophages phagocytic for mononuclear and polymorphonuclear leucocytes occur, and fibrin in balls and bands. In veins of all sizes subintimal proliferation of cells is observed similar to that observed in tuberculous meningitis and other diseases. The pulp is very rich in bacilli, but they are rarely intracellular.

In guinea-pigs inoculated subcutaneously with portions of the spleen or lymph glands from cases of human bubonic plague, or with cultures, lesions of a mixed character occur at the sites selected; infiltration and necrosis are extensive, but proliferative changes also take place, especially in the nuclei of sarcolemma sheaths.

¹ Am. Journ. of Med. Sci., 1901, cxxii., 377-395, 396-416, 416-426.

² Public Health Reports, United States Marine Hospital Service, 1901, xvi., 801-816.

³ Am. Journ. of Med. Sci., 1901, cxxii., 396-416.

In the regional lymph glands proliferation of cells and the growth of bacteria predominate over retrogressive changes and exudation, although the latter processes are marked in the glands nearest the inoculation. The bloodvessels show fewer changes than in human plague, but the periglandular tissues are involved.

In the spleen an intense congestion and a diffuse growth of bacteria occur with characteristic focal lesions, around what are probably bloodvessels occluded by masses of bacilli, both proliferation and necrosis of the spleen pulp cells take place, and following this an abundant migration of leucocytes.

The focal lesions of the liver are equally characteristic; foci of necrosis develop, and in some of these proliferative changes in the endothelial cells of the capillaries occur. The resulting lesions may simulate tubercles in the number of "epithelioid" cells produced; they, however, undergo no caseation and contain many easily demonstrable bacilli. Into and around such districts leucocytes are attracted.

Similar nodules may form in the lungs, especially in the alveoli about bacilli that lodge in the perialveolar capillary network.

In the adrenal, hemorrhage is usually observed in the medulla, and there may be extensive growth of bacilli in the cortex.

In the plague laboratory in the Institute for Infectious Diseases in Berlin, Kolle¹ made a number of experiments on the pathogenicity of the plague bacillus. He found that direct inoculations upon the conjunctiva with the blood of infected animals is the quickest way to pass bacilli through a series of animals. About 50 per cent. of white mice and a larger percentage of rats fed with infected material died, the primary bubo occurring in the submaxillary region, showing that animals may infect themselves by eating infected material. Cats are infected in the same way. As is well known, guinea-pigs are very susceptible to the plague bacillus; Kolle finds that the mere placing of bacilli upon the shaved skin causes infection beginning with a small local pustule. When few bacilli are present, the placing of bacilli upon the skin directly is regarded as the best method to secure infection. This quality of the bacillus to penetrate the unbroken skin may explain some features in the infection of human beings.

The exact manner of infection from rat to rat and from rat to man is still somewhat doubtful. Kolle's² efforts to transmit the disease to rats by fleas failed, and he favors the idea that the disease spreads by live rats eating parts of the dead. The experience in Sydney, in 1900, indicates that "the epidemic was caused by communication of the

¹ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvi., 397-421.

² Loc. cit.

infection from rats to man." There was plague among the rats, and the epidemic was coextensive with the epizootic. Fleas from infected rats, in one case at least, contained living plague bacilli pathogenic for guinea-pigs. In two instances flea-bites on patients caused vesiculopapular lesions containing bacilli in form like pest bacilli.¹ In San Francisco there has been no disease among the rats.

Edington² describes a fatal septicæmic disease among rats, not unlike pest, but caused by a different polymorphous bacillus, which is pathogenic for guinea-pigs, but not for rabbits.

The polymorphism of the plague bacillus on some media is emphasized by many writers—Skschiwan,³ Bruno Galli-Valerio,⁴ Kolle,⁵ Wilson,⁶ Novy.⁷ On salt agar (3 to 4 per cent.) long and short threads, with later branches, γ -shaped forms, spindles, spermatozoid forms, rings and spirals develop readily. These forms are not regarded as involutinal by Skschiwan and others. Wilson, in his comparative study of different cultures, found the bacillus fairly constant both morphologically and culturally. The stalactitic test, the behavior on salt agar, and the injection of guinea-pigs or rats are the most important points to be considered in doubtful cases.

Noguchi⁸ reports that plague bacilli survive temperatures ranging from -5° to -24° C. after an exposure of at least three weeks.

Schulze⁹ shows that *B. pestis* may retain its vitality and virulence for at least four years. It does not form endogenous spores, but the protoplasm is condensed and shrunken.

AGGLUTINATION OF *B. PESTIS*. Cairns¹⁰ studied agglutination in the recent Glasgow epidemic. Among his results I note the following: Agglutinins first appear toward the end of the first week; at first rather feeble (1 to 10) they gradually increase until the sixth or eighth week, when a gradual decline begins. In severe fatal cases the reaction was not marked, being more pronounced in cases of equal severity ending in recovery. It may be absent in mild cases. The reaction is of most diagnostic importance in severer cases during and subsequent to convalescence, when a bacteriological diagnosis is no longer possible.

¹ See valuable report of Department of Public Health at New South Wales on the Outbreak of Plague at Sydney, 1900, by Dr. J. Ashburton Thompson.

² Centralbl. f. Bakteriöl., Abth. I., 1901, xxix., 889.

³ Ibid., 1900, xxviii., 289, 290.

⁴ Ibid., 842-845.

⁵ Loc. cit.

⁶ Journal of Medical Research, 1901, vi., 53-58.

⁷ Am. Journ. of Med. Sci., 1901, cxxii. 416-426.

⁸ Proc. of Path. Soc. of Philadelphia, 1900, iv., 17-19.

⁹ Centralbl. f. Bakteriöl., 1901, xxix., 169, 170.

¹⁰ Lancet, 1901, i., 1746-1753; see, also, Markl, Centralbl. f. Bakt., Abth. I., 1901, xxix., 809-814.

PEST TOXINS. Markl¹ has investigated the pest toxins. *B. pestis* forms soluble toxins when freshly isolated and cultivated in bouillon, air being admitted. It is possible to immunize animals with pest toxins, their serum acquiring curative and preventive powers. The addition of antitoxic serum materially improves the efficacy of the anti-bacillary serum, and combined immunization with toxins and dead bacilli is the most efficacious. Heating of filtrates of pest cultures to 70° C. destroys their toxicity for mice, while they still continue toxic for rats, rabbits, and guinea-pigs, showing the presence of at least two different poisons.

Pseudodiphtheria Bacillus. In a research on the pathogenicity of the pseudodiphtheria bacillus and its relation to the Klebs-Löffler organism, Salter² extends the usual range of observations to include the virulence of the various bacillary cultures studied for different species of small birds. He concludes that there are to be met with diphtheria organisms of every grade of virulence. The weakest, known as Hoffmann's or the pseudodiphtheria bacillus, and representing the most attenuated form of the Klebs-Löffler bacillus, is capable of killing only certain highly susceptible small birds of the finch type. Organisms of a slightly higher degree of virulence can kill other and more resistant small birds of the bunting family; yet others, still more active, can cause larger birds (*merulidæ*) to succumb, while the most virulent of all can kill certain of the rodents, such as the guinea-pig.

Cache³ describes a culture of *B. diphtheriæ* which, under certain conditions (after growth on Ouchinsky's mineral medium), retains fully the power to produce a mycelial growth at the same time as it retains the biological properties of the virulent bacillus.

BACTERIUM DIPHTHEROIDES. Klein isolated this organism from a suppurating ulcer. It is like *B. diphtheriæ* morphologically; does not grow on gelatin nor under 25° C., nor in bouillon; grows slowly in agar and glycerin agar, and more rapidly in milk which is acidified and coagulated. The best growth is obtained on blood serum, the majority of the bacilli being oval, with a deeply staining central dot. Gram's stain is positive. It causes abscesses in guinea-pigs.

Tuberculosis. THE RELATIONS OF TUBERCLE BACILLI FROM BOVINE AND HUMAN LESIONS, AND VARIATIONS IN VIRULENCE. Koch's⁴ recent claim that bacilli from bovine tuberculosis are not capable of causing ordinary tuberculous infection in man has excited a great deal of attention. Koch bases his claim principally on the fact

¹ Zeitschrift f. Hyg. u. Infektionskr., 1901, xxxvii., 401-438.

² Trans. of Jenner Institute of Preventive Medicine, 1899, second series, 113-125.

³ Centralbl. f. Bakteriolog., 1901, xxix., 975-980.

⁴ Lancet, 1901, clxi., 187-191.

that pure cultures of bacilli from human tuberculous lesions injected in various ways into calves did not produce a progressive tuberculosis; hence human and bovine tuberculosis are not intercommunicable diseases. The momentous hygienic problems that centre about the relationships of human and bovine tuberculosis will lead to a full discussion of this question in the section on Hygiene.

The experimental proof of Koch's claim that bovine bacilli are not dangerous to man naturally cannot be furnished upon the scale that would be required to settle the matter. Baumgarten¹ relates that about twenty years ago he had occasion to examine after death some six or seven patients with malignant tumors who, during life, had been inoculated with cultures of tubercle bacilli from bovine sources in the hope that the bacilli might antagonize the inoperable tumor. Most of the patients survived several months, and in not a single one did Baumgarten find traces of tuberculosis. Baumgarten is inclined to agree with Koch that, practically, there may be but little danger to man from bovine tuberculosis, but he regards the bacilli as identical, the differences in their action resulting from the modifying influences of external conditions. Baumgarten and also Hueppe² cite examples of bovine tuberculosis having been produced by tuberculous material of human origin. Pearson³ states that several men have contracted tuberculosis by accidental inoculations in the course of post-mortems upon tuberculous cattle—an exceedingly significant fact, as it shows that bovine bacilli may be virulent for man, at least under some circumstances.

Ravenel⁴ and also others emphasize the fact that the bovine bacillus is much more active and virulent than the human bacillus, at least as regards the ordinary animals used for such experiments.

These few and incomplete abstracts show well enough that there is no justification for any relaxation in the methods in vogue for the purpose of limiting bovine tuberculosis. We seem to need more accurate studies upon the variability in virulence of both human and bovine bacilli from various sources and kinds of lesions along the lines followed by Theobald Smith, and more recently by Lartigau and others. Lartigau⁵ reports the results of a study of the variation in virulence of the bacillus of tuberculosis in man. Marked variations of virulence were found in cultures of tubercle bacilli from different human lesions, as well as from lesions of the same general type. There seems to be

¹ Berl. klin. Wochenschrift, 1901, xxxviii., 894-896.

² Lancet, 1901, clxi., 611-613.

³ Philadelphia Med. Journ., 1901, viii., 184.

⁴ Lancet, 1901, clxi., 443-448; and Univ. of Penna. Med. Bulletin, September, 1901, xiv.

⁵ Journal of Medical Research, 1901, vi., 156-162.

no manifest relation between morphology and virulence, but bacilli of great virulence were, on the whole, more difficult of cultivation than the less virulent organisms.

ACTION OF CINNAMIC ACID. Krompecher¹ took up experimentally Landerer's method of treating tuberculosis with cinnamic acid. Cinnamate of sodium was not found to have any preventive action on animals (rabbits) infected with virulent bacilli; and tuberculous animals succumb in spite of this treatment as rapidly as the controls, there being no tendency to healing observed in any of the animals. Hence, Krompecher concludes that Richter's² more favorable result with this treatment in the case of a single rabbit depended upon a spontaneous recovery from a disease caused by bacilli of greatly diminished virulence. This reasoning led Krompecher to study the virulence of various tubercle bacilli, human and piscine. A bacillus, probably originally isolated from human lesions,³ and grown artificially for six years, was found to have assumed many of the characters of the bacillus of avian tuberculosis; it produced a few small non-caseating nodules of giant cells and round cells in guinea-pigs, and seems to be without any influence upon their health. The piscine bacillus (Bataillon, Dubard and Terre) had similar effect. On the other hand, a virulent tubercle bacillus isolated from an inguinal gland of a tuberculous guinea-pig produced typical fatal tuberculosis, with caseation. Virulent tubercle bacilli killed by heat (120° C.) produced typical tubercles, with giant cells and caseation, whereas the avirulent bacillus and the piscine bacillus, when killed by heat, produced no changes whatsoever. This makes it likely that some of the discrepancies in the results of investigations upon the effects of dead tubercle bacilli are traceable to variations in the virulence of the bacilli employed. Animals inoculated with virulent bacilli, living or dead, reacted normally to tuberculin, the animals inoculated with dead avirulent bacilli gave barely any reaction. Tuberculin giving a typical clinical reaction was obtained from virulent bacilli, but tuberculin from fish bacilli or avirulent bacilli did not cause a typical clinical reaction.

Kraemer⁴ obtained better results in his experiments with cinnamic acid in rabbits. Complete healing was not produced, but as compared with the control animals the disease in the animals treated with the acid remained distinctly localized at the point of entrance and in the adjacent lymph glands.

¹ Ann. de l'Institut Pasteur, 1900, xiv., 723-749.

² Virchow's Archiv, 1893, cxxxiii., 376-386.

³ The exact source of origin of this bacillus, unfortunately, is not stated—a very important and necessary piece of information in studies of this kind.

⁴ Verhandl. Deutsch. Patholog. Gesellsch., 1901, iii., 121.

TOXINS AND CHEMICAL COMPOSITION OF B. TUBERCULOSIS. Frenkel and Bronstein¹ state that cultures of tubercle bacilli may be made to yield a number of substances, some of which are markedly toxic and produce in graduated doses active immunity, the serum of the immunized animal being strongly antitoxic with respect to every toxic substance. They employed the technique of Maragliano and his pupils.

P. A. Levene,² in the course of a valuable study of the chemical composition of the tubercle bacillus, isolated a peculiar coloring matter; a fat or wax-like substance which forms 30 per cent. of the body substance of the bacillus, and is the only component that holds the stain in presence of acids; three nucleo-proteids of different coagulated points which probably are the toxic agent of the bacillus; glycogen or a glycogen-like substance.

TUBERCULOSIS AND COLD-BLOODED ANIMALS. Bataillon, Dubard and Terre, Auché and Hobbs, and Lubarsch claim that the tubercle bacillus is greatly modified in its biological characters by a sojourn in the bodies of frogs and other cold-blooded animals. These authors also make contradictory statements concerning the production of tuberculosis in frogs, and they far from agree in their statements concerning the diminution of virulence and other changes in the bacillus under these circumstances. v. Sion³ calls attention to these discrepancies, and describes the results of a series of experiments planned to throw light on the influence of the organism of cold-blooded animals on the bacillus of human tuberculosis. He finds himself at variance with all the writers mentioned: Tubercle bacilli produce no changes in frogs; it is not even generalized, as claimed by Lubarsch; and is not changed in form, biological characters, or virulence. Lubarsch,⁴ however, insists after renewed experiments that tubercle bacilli inserted into the lymph sac of frogs are disseminated throughout the body of the animals, generally without producing any lesions, and lose their virulence for guinea-pigs, at least for a time. Hormann and Morgenroth,⁵ and Nicolas and Lesieur,⁶ also failed to produce tuberculosis in various fishes after feeding them with tuberculous material for a long period. Tubercle bacilli from the feces of the fishes did not show any change in virulence.

FISH TUBERCULOSIS. *B. tuberculosis piscium* (Bataillon, Dubard and Terre) stains in the same way as the bacilli of avian and human tuberculosis, but it is distinguished from these by growing at ordinary

¹ Berl. klin. Wochenschrift, 1901, xxxviii., 861-863.

² Journal of Medical Research, 1901, vi., 135-144.

³ Centralbl. f. Bakteriöl., Abth. I., 1900, xxvii., 710-720.

⁴ Ibid., 1900, xxviii., 421-430.

⁵ Hyg. Rundschau, 1899, ix., 857-859.

⁶ Comp. rend. de Soc. biol., 1899, li., 774.

temperature and by being innocuous for guinea-pigs and birds. It was originally obtained from spontaneously diseased carp. Undoubtedly some of the confusion among the authors just mentioned depends upon erroneous notions concerning the interchangeability of these bacilli, which probably has been overestimated. Ledoux-Lébard¹ finds that the tuberculin of *B. piscium* is less active as a thermogenic agent than Koch's tuberculin. He has studied fully the lesions of *B. tuberculosis piscium* in frogs, in which it produces a distinct tuberculosis.

HISTOLOGY AND HISTOGENESIS. Wechsberg² took up the still unsettled question as to the primary effect of *B. tuberculosis* upon the tissues and cells. The various phases of this question, including as it does the study of the origin of the tubercle, have been made the subject of much investigation. The views of the investigators diverge as regards many and important details. In general it may be said that it is agreed that *B. tuberculosis* or its toxin exercises a stimulus upon the fixed cells (Baumgarten), or upon the wandering cells (Metchnikoff), or upon both these cells, whereby arise the epithelioid cells. Baumgarten especially has insisted upon the primary formative stimulus of the bacillus upon the fixed cells. Weigert denies the possibility of a direct formative stimulus, and urges that through some injury or other the hinderances preventing cell proliferation are removed. This injury may affect the old cells or it may involve the intercellular substance. At Weigert's suggestion Wechsberg undertook to determine whether a primary injury to the tissues is demonstrable in tuberculosis. For this purpose suspensions of tubercle bacilli were injected into the circulation and into the anterior chamber of the eyes of rabbits, and the resulting lesions were examined at varying intervals. He finds that the primary effect of the tubercle bacillus consists in a destruction of the pre-existing fixed cells—endothelium, alveolar epithelium, cells of iris—and of the collagenous and elastic intercellular material. This starts cell proliferation, the new cells retaining to a certain extent their "bioplastic" energy, which keeps up proliferation. The sinister influences of the bacillus generally prevent the full development of these cells into mature tissue, and caseation frequently occurs.

Morel and Dalous³ also studied the question of histogenesis of tubercle, using as their material the lungs of rabbits after the intratracheal inoculation of bacilli. Their conclusions, based upon the morphological appearances noted at various stages, are to the effect that in this instance the tubercles in the pulmonary alveoli and in the bronchi develop exclusively from leucocytes and dust cells, and that the fixed

¹ Ann. de l'Institut Pasteur, 1900, xiv., 535-554.

² Ziegler's Beiträge, 1901, xxix., 203-232.

³ Arch. de Méd. exp. et d'Anat. path., 1901, xiii., 225-242.

cells of the alveolar walls and the epithelial cells of the bronchi play no rôle in the histogenesis; hence they favor Metchnikoff's view that tubercle is a massing of phagocytes.

Orth¹ shows that in tuberculous and other forms of chondritis there is a marked emigration of leucocytes and wandering cells into the cartilage from the neighboring granulation tissue. The ground substance is striated, and the cells follow rather well-fixed routes. As the leucocytes and other cells accumulate in the lacunæ these become large. The destructive changes in the ground substance are ascribed to toxins. The complete research upon which these statements are based is published by Heile.²

HISTOLOGICAL DIFFERENTIATION BETWEEN TUBERCULOSIS AND SYPHILIS. This important question was discussed at the meeting of the German Pathological Society, apropos of Baumgarten's³ remarks upon the differential diagnosis between tuberculous and gummous orchitis. In typical cases there are no difficulties. The demonstration of tubercle bacilli is a sure criterion of tuberculosis, but in chronic tuberculous lesions in the testicle and elsewhere bacilli may not be found. As syphilis and tuberculosis may occur together, even the finding of tubercle bacilli is not always decisive, and further appeal must be made to histological characteristics. Baumgarten makes the unexpected statement that giant cells of the Langhans type do not occur in pure syphilitic lesions, because in cases with giant cells he has always found tubercle bacilli no matter what the clinical or anatomical characteristics. In the absence of foreign bodies and large parasites, giant cells, he claims, are always indicative of tuberculosis. This statement met with the opposition of Hansemann, Marchand, and others, and it certainly does not seem warranted from the frequent occurrence of giant cells in typical syphilis of the liver. Baumgarten suggests that some of his cases were combinations of syphilis and tuberculosis. Careful study of proper material, aided by suitable experiments, will undoubtedly determine this point. In blastomycetic infections of the skin occur numerous giant cells, while tubercle bacilli are absent and the results of inoculations into guinea-pigs negative as regards tuberculosis.

Among the more important differences between the lesions of tuberculosis and syphilis Baumgarten mentions that the cells of syphilitic lesions are smaller than in the tuberculous, which consist of larger fibroblasts or epithelioid cells except in the lymphoid tubercle, and here bacilli are usually found easily. Furthermore, syphilitic foci are

¹ *Centralbl. f. Path.*, 1900, xi., 706-707.

² *Virchow's Archiv*, 1901, clxii., 265-287.

³ *Verh. Deutsch. Path. Gesellsch.*, 1900, iii., 107-121.

vascular, tuberculous avascular. In syphilis direct transformation into connective tissue occurs, whereas in tuberculosis cicatrization is usually secondary to caseation—another statement to which I would take exception, as did Marchand, who holds that tuberculous tissue may change directly into mature tissue. In gummata the necrosis slowly obliterates structural details, so that in the caseous centres one may still recognize the outlines of the cells. In tuberculosis structural details are lost early. As regards the testicle, tuberculosis generally begins in the canals of the epididymis, the epithelium of which forms giant cells, while syphilis begins in the interstitial tissue, where tuberculosis is rare as a primary lesion. Orth laid stress on the formation in syphilitic lesions of elastic fibres which are absent in tuberculosis. Chiari pointed out that fibrous orchitis, often held as syphilitic, is commonly of gonorrhœal nature, and starts in the canals.

Federmann¹ finds that the tuberculous process is most frequently intratubular and leads to early disappearance of the elastic elements of the testicle; while the syphilitic process is interstitial, causing only a crowding together of the canals, the elastic tissue remaining intact. In interstitial tuberculous orchitis the conditions are the same as in the syphilitic. The rapid destruction of the elastic elements in tuberculosis points to the presence of some special chemical substance or substances, especially in the stage of inflammatory proliferation; caseation does not affect the elastic fibres, which remain in the caseous material as they were at the time it set in. Softening and suppuration quickly destroy the fibres.

Lubarsch² shows by means of suitable cases that the so-called miliary gummata of the liver—heaps of mononuclear round cells—may occur without syphilis, and that they are consequently not distinctive of congenital lues. There are no fundamental differences between the syphilitic and non-syphilitic foci. The syphilitic rarely contain polynuclear leucocytes, and there is in these cases also a marked proliferation of fibrous tissue, which is usually absent in the non-syphilitic instances. The cell accumulations are regarded as the result of toxic and infectious influences. Saxter regards the so-called miliary gummata as the normal cell masses of the fetal liver that persist for a longer or shorter time.

SERUM REACTION IN TUBERCULOSIS. Beck and Lydia Rabinowitch³ claim, from the study of carefully controlled bovine material, that Arloing-Courmont's serum reaction with homogeneous cultures of tubercle bacilli is not serviceable for the diagnosis of tuberculosis because

¹ Virchow's Archiv, 1901, clxv., 469-497.

² Verh. Deutsch. Path. Gesellsch., 1900, iii., 98-101.

³ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxviii., 205-224.

of the uncertainty of the results, being often positive in the absence of the disease and negative in its presence. Courmont,¹ on the other hand, reports that Arloing has reached directly opposite results. Bendix² and others think that this divergence depends upon the character of the cultures used by the workers. F. de Grazia³ reports unsatisfactory results in the case of human patients, and does not ascribe to the test any diagnostic significance. Romberg⁴ attributes the failure of these authors to an erroneous technique. He uses dead pulverized and emulsified bacilli, large quantities of serum, and keeps the preparation under observation for a long time. He regards agglutination as positive evidence of active tuberculosis, while a negative result means either no tuberculosis, absolutely circumscribed and inactive tuberculosis, or a rapidly progressing advanced tuberculosis.

Buard⁵ reports success with the reaction of agglutination in several cases of tuberculosis otherwise latent. He regards the test as of especial value in less advanced cases. Carriere⁶ finds the reaction with homogenized living cultures to be difficult, but, as it is inoffensive and sensitive, he regards it as a valuable diagnostic means.

ACID-PROOF TUBERCULOID BACILLI. D. Murray Cowie⁷ has studied the occurrence of acid-resisting bacilli in the lower animals. His interesting results may be summarized as follows :

1. Acid-resisting bacilli are found in many of the lower animals, more especially in the smegma of the horse, dog, guinea-pig, and white rat. No such organisms were found in the rabbit or cat. Scrapings from the testes and udders of cattle contained acid-proof bacilli in five of eight examined.

2. Many of these bacilli resemble the tubercle bacillus and the smegma bacillus of man.

3. The acid-resisting bacilli are undoubtedly of different species. There is good reason to believe that the term smegma bacillus denotes not a definite species, but rather a group of organisms having common staining properties.

Scrapings from the various sources indicated were suspended in water and cover-slips stained with hot carbol-fuchsin, treated thoroughly with fresh 25 per cent. nitric acid solution in water, washed in water, and counterstained with methylene blue. Cowie gives a useful summary of the literature on acid-resisting bacilli.

¹ Verh. des Congresses f. Innere Medicin, 1901, xix., 300.

² Ibid.

³ Gaz. degli Ospedali, 1901, September 8.

⁴ Deutsch. med. Wochenschrift, 1901, 273-275 and 292-296.

⁵ Journ. de Phys. et Path. gén., 1900, ii., 797-803.

⁶ Comp. rend. de Soc. biol., 1901, liii., 746-747.

⁷ Journal of Experimental Medicine, 1900, v., 205-214.

Herr,¹ working in Breslau and its vicinity, finds that acid-proof bacilli are very widely distributed in nature, occurring upon grasses, in cow-dung, on timothy seed, and on grains; but he found them especially freely in the soil of fields. He regards the soil as the great reservoir for these organisms. In order to cultivate them from the soil he used sterile hay infusion, which was mixed with a small quantity of soil and placed in the incubator.

Neufeld² investigated the smegma bacillus, and concludes that there are at least two distinct organisms in smegma, one of which is absolutely acid-proof and very much like bacillus tuberculosis, and the other presents more or less similarity to diphtheria bacilli (Czaplewsky-Laser's smegma bacillus).

This view is taken by C. Fraenkel,³ who discusses the cultivability of the smegma bacillus, and he reaches the conclusion that the real smegma bacillus has not yet been grown in pure culture, the colonies described by Laser and Czaplewski being in reality cultures of a pseudo-diphtheria bacillus which is quite constant in the smegma. This later bacillus is acid-proof at first, but soon loses nearly all of its power to retain carbol-fuchsin. Dahms⁴ also describes cultures of what he regards as the smegma bacillus, but they do not seem to differ from those of Laser and Czaplewski.

Karlinski⁵ found acid-proof bacilli in the nasal secretion of 19 persons of 235 examined. Sometimes they were present in very great numbers. In a large number of the cases he succeeded in obtaining pure cultures consisting of a genuine bacillus, which did not prove pathogenic except for guinea-pigs, in which intraperitoneal injections produced fibrinous exudate and nodules of round cells with necrotic centres, but free from giant cells. The bacillus is as resistant to decolorization with acids and with alcohol as *B. tuberculosis*. It grows readily on most media, and produces an unpleasant, sweetish odor. It seems to differ from other acid-proof bacilli, and may be distinguished morphologically from leprosy bacilli by its larger size, its greater resistance to decolorization in alcohol, its extracellular occurrence and by failure to occur in bundles and sheaves.

Mironescu⁶ cultivated an acid-proof tuberculoid bacillus from the feces of a suspected typhoid. The colonies on glycerin-agar plates appeared whitish, dry, wrinkled, and under the microscope radiating.

¹ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxviii., 201-204.

² Arch. f. Hygiene, 1900, xxxix. (Quoted by Fraenkel.)

³ Centralbl. f. Bakteriol., 1901, xxix., 1-5.

⁴ Journ. of Am. Med. Assoc., 1900, xxxiv., 983-986 and 1045-1048.

⁵ Centralbl. f. Bakteriol., Abth. I., 1901, xxix., 521-531.

⁶ Zeitschrift f. Hygiene u. Infektionskr., 1901, xxxvii., 497-500.

The resistance to acids and to alcohol diminished in artificial culture, but became more marked again on passage through animals. Guinea-pigs injected intraperitoneally with emulsions of bacilli in sterile melted butter died in from ten to fourteen days, and presented the same lesions as result from bacilli isolated from butter (see Mayer, etc., *PROGRESSIVE MEDICINE* for March, 1901, 326-327). When injected without butter the bacillus only produces a local abscess.

Frey¹ finds that Moeller's grass bacillus II. produces a fatal nodular disease in cold-blooded animals (frogs).

Hölscher² emphasizes that the acid-proof tuberculoid bacilli differ from the genuine bacilli especially by their growth at lower temperature and by the formation of pigment. They may be cultivated readily directly from animal lesions. While pathogenic for animals, they do not cause genuine tuberculosis, but resemble in their action more the pus cocci. The best differential method is the study of pure cultures.

Benevenuti³ found acid-proof and alcohol-proof tuberculoid bacilli in the sputum of pulmonary gangrene. The bacilli differ from tubercle bacilli by being non-pathogenic, by their cultural peculiarities, especially their more rapid growth.

Ernst Schutz⁴ reviews the morphological, tinctorial, and cultural peculiarities of this group of organisms.

Kedrowski⁵ cultivated in pure growths from leprous lesions a bacillus or bacilli which form branching threads. The growths were secured upon a medium made from extract of human placenta. The original acid-proof character was retained by the organism, but only occasionally and partially. In the majority of the growths the resistance to acids was reduced greatly as compared with the degree observed in the case of bacilli in the tissues. These observations correspond fairly well with previous results by Bordoni-Uffreduzzi, Czaplewski, Spronk, and others. In the absence of successful animal experiments, and in view of the frequent occurrences of more or less acid-proof branching organisms upon the skin, it must be concluded that the problem of securing in pure culture the organism of leprosy is still open.

Barannikow⁶ points out that the organisms in leprous lesions occur under various and complicated forms, the majority being acid-proof. There occurs a tangled mass of fine threads arranged more or less circu-

¹ *Centralbl. f. Bakteriöl., Abth. I.*, 1901., xxix., 530-531.

² *Ibid.*, 425-428; also, *Aus dem path. Institut zu Tübingen*, 1901, iii., 391-414.

³ *Gaz. d. Ospedali*, 1901, Abstr. in *Centralbl. f. Path.*, 1901, xii., 348.

⁴ *Inaugural dissertation*, Heidelberg, 1900.

⁵ *Zeitschrift f. Hygiene u. Infektionskr.*, 1901, xxxvi., 52-69; also *Arch. russes de* 1900, x., 449-468.

⁶ *Centralbl. f. Bakteriöl., Abth. I.*, 1901., xxix., 781-786.

larly, staining more or less feebly, and also glistening chains lying in masses which do not stain.

Moeller¹ discusses the acid-proof and alcohol-proof tuberculoid bacilli, and concludes that in spite of many outward and obvious resemblances between them and *B. tuberculosis*, the latter retains undivided the distinction of causing human tuberculosis.

Actinomycelial Processes. Several interesting cases of infections with different kinds of ray fungi have been reported. The descriptions of the authors leave no doubt of the great variability, morphological and otherwise, of the pathogenic ray fungi. The noteworthy cases of pulmonary infections described by Norris and Larkin, Aoyama and Miyamoto, and by Musser form valuable additions to the observations on atypical pulmonary actinomycosis (streptotrichosis). Undoubtedly the number of cases of this kind is greater than ordinarily suspected, and it seems to me it is of great importance that the clinical history of these infections is studied as carefully as possible in order that the correct etiological diagnosis may be reached early. The nomenclature of these processes is still in a state of confusion, actinomycosis being generally applied to processes in which typical fungous granules are present, and streptotrichosis to processes in which the filaments are spread out more diffusely in the tissues; but this distinction is not definite enough and it is not consistently carried out. As pointed out elsewhere and previously, the term streptothrix should not be applied to ray fungi according to the law of priority generally observed in botanical nomenclature, because it has been used since 1834 for other forms. It is too early as yet to attempt a definite division of the pathogenic ray fungi (actinomycetes). The fact that actinomycosis, typical and otherwise, may be caused by organisms which do not correspond to the type described by Boström as the only cause of human and bovine actinomycosis, nor tally completely with the principally anaërobic actinomyces of Wolf and Israel, is illustrated again by the results obtained by Silberschmidt² from the examination of a number of cases both human and bovine. Sternberg³ also believes that human actinomycosis is caused by at least two different fungi. The idea that actinomycosis is a specific disease caused by a single organism must be dropped, I think. A number of similar organisms may cause the same clinical and anatomical picture.

In the sputum, the lungs, the pus in abscesses in the liver, loin, and elsewhere of a sixty-five-year-old diabetic, Silberschmidt found only

¹ *Lancet*, 1901, clxi., 204, 205; *Centralbl. f. Bakteriöl.*, 1901, xxx., 513-523.

² *Zeitschrift f. Hygiene u. Infektionskr.*, 1901, xxxvii., 345-380.

³ *Wien. klin. Wochenschrift*, 1900, xiii., 548-551.

branching filamentous organisms. The lungs, which were the seat of chronic inflammatory changes, are regarded as the primary focus, but it was not possible to demonstrate the organisms in sections of the tissue. Pure cultures were obtained in bouillon kept in a vacuum and also in the depth of ordinary aerobic bouillon tubes. Subcultures were successful in bouillon. The organism produced pus in rabbits and mice, but the pathogenicity was not marked. In the pus from the animals there formed, after it had been kept for some time, small granules or colonies of threads. From a number of other cases, mostly typical, with granules in the pus, including actinomycosis of the lachrymal canal (see PROGRESSIVE MEDICINE, March, 1901, p. 329), Silberschmidt obtained similar organisms. These organisms are all characterized by an essentially anaërobic growth; the colonies remain small and circumscribed, and do not send out mycelial prolongations; there is no growth on gelatin nor at the room temperature; the threads are mostly short, and the growths are friable. Silberschmidt emphasizes that the distinctions laid down by some—*e. g.*, Poncet and Bérard—between actinomycosis and pseudo-actinomycosis cannot be carried out successfully. I may point out that pseudo-actinomycosis is used by Poncet and Bérard to designate processes caused by branching organisms which do not form kernels in the tissues (hence Silberschmidt's first case would belong here), while Berestneff applies it to processes caused by bacilli forming aggregations in the pus, resembling the kernels of actinomycosis. If used at all, pseudo-actinomycosis should be reserved for the occasional cases of the latter group. Silberschmidt also indicates that many of the ray fungi, at least in some of their morphological and even cultural peculiarities, resemble pseudo-diphtheria bacilli, and that it is becoming more difficult to draw the line between bacteria and fungi. This is illustrated by the organisms described by Kedrowski (see further on) as probable causes of leprosy, by Bongert's corynethrix pseudo-tuberculosis murium, as well as by others.

In Silberschmidt's cases mixed infection was not as frequent as usual, and he succeeded in obtaining cultures quite easily by means of aerobic and anaërobic cultures on agar and bouillon. The danger of accidental contamination of media with ray fungi, probably from the air, should be borne in mind, because I have seen repeatedly one or two typical colonies spring up on the plates used by students in the laboratory in routine bacteriological examinations.

PLEOMORPHOUS RAY FUNGUS THE CAUSE OF NECROTIC AND CATARRHAL BRONCHOPNEUMONIA. From two cases of bronchopneumonia characterized by an intense catarrhal and necrotic inflammation and actinomycelial colonies of rods and filaments in the bronchi

Norris and Larkin¹ obtained a streptococcus on ordinary media, the ray fungi refusing to grow. The introduction of fungal clusters and pus from the bronchi into the trachea and into the ear-vein of rabbits produced pulmonary abscesses and empyema, the pus containing filaments and rods identical with those in the colonies in the human lungs. By inoculating and re-inoculating fresh sterile kidneys from normal rabbits with empyemal pus of a rabbit injected into the ear-vein with material from their second case a ray fungus was finally isolated in pure culture, and, after much difficulty, induced to grow on artificial media, plate cultures being obtained from the eighth generation on broth. On neutral or 0.5 per cent. acid glycerin-agar the colonies look more like those of bacteria than of a ray fungus, being loosely adherent and whitish. A scanty, adherent growth also developed on Löffler's serum and ascitic serum. In both small discoid colonies adhere to the sides of the tubes, leaving the broth clear; later the granules become fluffy and fall to the bottom. There is no fermentation of grape-sugar broth. Acid is produced in milk and broth; milk is clotted. There is no growth on potato. The optimum temperature is 37° C.; growth takes place equally well with and without oxygen; all growths are odorless; the vitality is brief.

In the lesions in the human lungs and those produced experimentally in rabbits and guinea-pigs rods, filaments, and curious forms were found free or in clumps, with terminal bulbs enclosing central filaments. The bulbs stain well with Weigert's fibrin method. On rabbit's kidney the growth was mostly rod-like, with metachromatic swellings and deeply staining granules. The filaments in broth cultures appear beaded when stained with methylene blue, but Gram's stain is diffuse and intense. True branching forms are numerous in pure cultures. The pleomorphism of the organism is marked. Alcohol-proof forms occur in later generation on broth, but decolorization by weak acid solutions is prompt after staining in hot carbol-fuchsin.

The fungus is pathogenic for rabbits and guinea-pigs, producing local death of tissue and reactive zones of granulation tissue enclosing discoid granules of the fungus. Death rarely results from its action.

The fungus of Norris and Larkin resembles most *Actinomyces Israeli*; it is less pathogenic for animals and not as strictly anaërobic as *A. Israeli*. It belongs to the atypical, pleomorphous ray fungi, which produce characteristic clusters in the lesions. The necrotic changes in the lungs of the two cases described distinguish the lesions from the ordinary bronchopneumonic actinomycosis. The authors are congratulated on the skill and patience that finally led to the isolation of the fungus in pure culture.

¹ Journal of Experimental Medicine, 1900, v. 155-193.

ACID-PROOF RAY FUNGUS AND PNEUMONIA AND BRAIN ABSCESS. Aoyama and Miyamoto¹ describe an interesting case of pulmonary infection with an acid-proof ray fungus. The clinical symptoms extended over a period of only seven days, and were characterized by cough and sputum, the latter containing the organisms in large quantities. The lungs contained a purulent cavity in the midst of caseous pneumonic infiltrations. The actinomyces was readily isolated from the pus. The organism was pathogenic for various animals, producing tuberculoid nodules and fibrinohemorrhagic infiltrations. The organism resembles that described by Eppinger, being probably identical with Buchholz's streptothrix.

Musser² found acid-proof, filamentous branching organisms in the sputum of a fatal case of bronchitis and bronchopneumonia, and also in the pus and in the walls of a large cerebral abscess in a second case, the autopsy being limited to the brain. Nearly two hundred sections were examined before Dr. Pearce, who made the bacteriological examination, found two masses of tangled threads radiating from a common centre. One such mass was found in the pus. It is suggested that the organism may have died out. Cultures were unsuccessful. Carbol-fuchsin, followed by Gram's solution and aniline oil, was used for staining.

Ucke³ has met with ray fungi in pulmonary abscess, in pulmonary gangrene (three cases), in purulent pleuritis, in a subphrenic abscess breaking through into the lungs, and in a case of noma. Only in the latter case were cultures successful.

ACTINOMYCOSIS OF THE FOOT. Tusini⁴ describes an instance of actinomycosis of the foot in a woman, aged thirty-four years, who at the age of ten years received a wound on the corresponding leg. A rather swollen, brownish scar formed, in the vicinity of which characteristic nodules sprang up after an interval of fourteen years. The subsequent clinical course and the changes in the foot are characteristic of the pale or yellow variety of mycetoma or madura foot, there being wide-spread local extension, especially downward into the foot, without any involvement of distant tissues through lymphatic or hematogenous transport. The foot was amputated. The actinomycotic process had spread by continuity to various soft tissues of the foot, to the bone, tendons, and joints. Typical actinomycelial granules were found in the pus, and a ray fungus producing orange-red pigment was isolated in pure culture.

¹ Mitteil. aus der medicin. Fakultät der Kaiserl. Japanischen Universität zu Tokio, iv., 231-276; abstr. in Centralbl. f. Bakteriol., 1901, xxix., 262, 263.

² Chicago Medical Recorder, 1901, xxi., 69-85.

³ Quoted by Musser, loc. cit.

⁴ Arch. f. klin. Chirurgie, 1900, lxii., 249-287; also, reprint *Sopra l'actinomicosi deli piede*, Roma, 1900.

This fungus forms spore-bearing hyphæ; it does not liquefy gelatin; it is pathogenic for guinea-pigs, producing abscesses and nodules, from which the organism is recovered; at other times a fatal marasmus without any other lesions results.

The fungus isolated by Tusini differs in certain important characteristics from actinomyces or streptothrix maduræ of Vincent, especially in being virulent for guinea-pigs. Tusini does not give his organism any special name. It corresponds closely to actinomyces rubra of Gasperini. With Tusini, I think that the name actinomycosis of the foot correctly describes the condition, both from the clinical, anatomical, and etiological points of view. The long period of incubation—fourteen years—is noteworthy; others have described instances of similar character.

ACTINOMYCELIAL MYELITIS SECONDARY TO BRONCHIECTASIS. Chiari¹ describes a case of suppurative myelitis following bronchiectasis. In the pus of the abscesses in the cord as well as in the vessels of the cord a branching, filamentous fungus was found; but, unfortunately, it was not isolated in pure culture. Though growing in the form of clusters, there were no clubbed extremities seen; many of the threads broke up into rows of coccoid bodies; Gram's stain was positive. Of eight instances of pure hematogenous myelitis collected from the literature three were secondary to bronchiectasis. This large percentage and the nature of the case described by Chiari lead him to the idea that possibly this relationship is dependent on the presence of ray fungi in the bronchiectatic cavities. He mentions an instance of actinomycotic cerebral abscesses in a man with numerous bronchiectatic cavities, in the walls and the contents of which were numerous fungus clusters.

TRANSFORMATION OF ACTINOMYCES ISRAELI INTO AEROBIC TYPE(?). Mertens² cultivated a ray fungus from the contents of an abscess of the neck, which at first grew only under anaërobic conditions; but later, in the seventh generation, surface cultures appeared, which soon became white, as if frosted. At first growth took place only at body temperature, but after some time also at room temperature. Mertens interprets this change of characteristics as signifying the transformation of an actinomyces of the Wolff-Israel type into the aerobic type of Boström. Implanted into the anterior chamber of rabbits it produced typical clusters, with characteristic club-shaped outgrowths.

Oidia and Blastomycetes. **BLASTOMYCETIC DERMATITIS.** Howard T. Ricketts³ describes a new mould fungus as the cause in five cases of lesions like those of cutaneous blastomycosis. These cases were clin-

¹ Zeitschrift f. Heilkunde, 1900, xxi., 351-372.

² Centralbl. f. Bakteriöl., Abth. I., 1901, xxix., 649-654.

³ Journ. of Boston Soc. of Med. Sci., 1901, v., 453-459.

ically and histologically quite characteristic. In addition to the usual features, including miliary abscesses and doubly contoured organisms, eosinophilous cells were especially conspicuous in the infiltrate. Hyphal colonies developed upon the maltose-agar tubes (Sabouraud's formula) inoculated with the pus. Aërial hyphæ formed of fine, branching threads with pedunculated conidia, which multiplied *in situ* by budding. Growths also occur on potato, blood serum, gelatin, and bouillon. In bouillon puffy masses form. Intravenous injection of a dog produced extensive mycosis of an entire lung, the nodules containing spherical and budding cells, which in cultures grew out into hyphæ. Ricketts concludes that a group of closely related organisms with rather constant differences cause blastomycetic dermatitis; that the simpler organisms probably are adaptation forms or conidial stages of a more complex mould fungus. He thinks it not unlikely that the protozoic disease of Posadas and others may be a general invasion of the organisms that locally cause the picture now known as blastomycetic dermatitis, especially since Ophüls and Moffitt isolated a mould fungus from the so-called protozoic disease which is not unlike the fungus he has studied.

BLASTOMYCETES IN THE TONSILS. Bertarelli and Calamida¹ examined a large number of tonsils for blastomycetes, and they report that blastomycetic forms were present in nine of twelve normal tonsils examined and in thirty-two of thirty-three hypertrophied, but with the reservation that they were not able to differentiate carefully enough between supposed blastomycetes and hyaline bodies present in these organs. Numerous cultures were made from forty-four tonsils, and in four instances pure cultures of blastomycetes were obtained, some from normal tonsils. They conclude that the finding of blastomycetes in the tonsils, normal as well as pathogenic, is purely accidental.

AGGLUTINATION OF BLASTOMYCETES. Malvoz² studied the agglutinating and other properties of the serum of animals treated with various blastomycetes. Only a moderate degree of agglutinating power is acquired. Cytotoxic action (*in vitro*) does not develop, possibly because of the protective action of the capsule, possibly because of the absence of fixator in the serum. Neither did he find antisucrase in the serum of animals treated with saccharine cultures of fermentating organisms.

Bissérié³ injected brewer's yeast into the abdomen, under the skin, and intravenously in rabbits. The serum acquired the property of agglutinating the yeasts injected.

¹ Centralbl. f. Bakteriol., Abth. I., 1901, xxx., 60-65.

² Ibid., xxix., 688-693.

³ Comp.-rend. de Soc. biol., 1901, liii., 199-201.

In some experiments of my own with blastomycetes or oidia isolated by Dr. Ricketts from blastomycetic dermatitis only slight agglutination was observed with the serum of inoculated animals.

GENERAL PATHOLOGICAL HISTOLOGY.

The Embryological Basis of Pathological Anatomy and Histology. Minot,¹ in the Middleton-Goldsmith lecture before the New York Pathological Society, March 26, 1901, discussing the relation between embryology and pathological anatomy and histology, points out that both these branches of morphology deal with the development of anatomical forms. Naturally the laws of normal organization are of great import in the study of abnormal structure and function. During the differentiation of the fertilized ovum, each part of which is capable of producing any adult tissue, each successive stage limits the range of potentiality until the fate of the cells is determined and limited by their relations to the germ layers, the ectoderm, entoderm, and mesoderm (mesothelium and mesenchyma). Recent efforts to upset the doctrine of the specificness of the germ layers he regards as failures because based upon erroneous observations. Pathological proliferations may be regarded as still governed by the laws of the specificness of the primary germinal strata. He urges the use of the word mesothelium to designate the epithelial lining of the peritoneal and pleural cavities because it is of a different genesis than the endothelium of the blood-vessels and lymph-vessels.

In normal development constructive changes, such as are seen in growth and differentiation, are succeeded by destructive changes. This series of progressive and regressive changes Minot designates as "cytomorphosis," meaning thereby that the complete structural cycle, cells and generations of cells pass through from a mass of undifferentiated protoplasm to their final destruction. Cell death may be direct or indirect. Indirect cell death may be of the nature of necrobiosis when preceded by structural changes of a degenerative type, or it may be preceded by growth, as in the uterus, when it is also termed hypertrophic degeneration. Direct and indirect cell death becomes pathological when it occurs at an abnormal time or in an abnormal place. Dead cells are removed by the same means under normal and pathological conditions, namely, by mechanical and chemical means and by solution. It is therefore clear that embryology and pathological morphology deal with similar problems. Both await the elucidation of cell differentiation and histogenesis, toward which experimental morphology

¹ Boston Med. and Surg. Journ., 1901, cxliv., 295-305.

is directing its efforts along new lines, namely, the modern physico-chemical theory of living structures. "Between the histographical world of to-day and the architectural world of stereochemistry who will dare prophesy what rich territories may exist."¹ When cell differentiation is brought under control it may become possible to arrest a number of diseases at their point of departure, namely, in erroneous differentiation.

Histology of Inflammatory Processes. Herxheimer² has studied the histology of fibrinous inflammation of serous membranes and of the intestines. He failed to find any transition between the proliferated surface cells of serous membranes and connective tissue, thus confirming the view of Buttner, Ribbert, Neumann, and others. Many appearances were observed that indicate proliferation of these cells in direct response to formative inflammatory stimuli. Herxheimer then describes fibrin in pseudomembranous processes. He finds that Kockel's method for staining fibrin is of value because applicable to tissue hardened in chromic acid mixtures, as Weigert's more elegant method does not then stain them. By means of a number of staining methods it is shown that the fibrillar network and the masses and clumps found in the intestines are composed of fibrin, as believed generally. The fibrin occurs in the spaces of the submucosa, especially in close relation to the blood-vessels, and also upon the surface of and in the mucosa. All appearances point to the exudative origin of the fibrin.

Saltykow,³ under Marchand's direction, reinvestigated the histology of inflammations of serous membranes, with the particular object of demonstrating the origin of the fibrinous membranes. He concludes, as many others before him, that they are the products of exudation, and that there is no support for Neumanu's teaching that a fibrinoid degeneration of fibrous tissue occurs.

Walbaum⁴ found that in many cases of peritonitis the deeper sub-serous layers of the intestinal wall participate actively in the inflammatory process, and show cellular infiltration, proliferation of the fixed cells, fibrinous exudation, and hemorrhages. If the peritonitis does not too rapidly lead to fatal termination deep-seated degenerations of various kinds develop in the protoplasm and the nuclei of the nerve cells in the intestines.

Kurpjuweit⁵ studied the inflammatory changes in bone following the application to the surface of silver nitrate. Under the superficial layer

¹ Barker, Study of Anatomy, Journ. of Am. Med. Assoc., 1901, xxxvi., 699-705.

² Virchow's Archiv., 1900, clxii., 443-475.

³ Ziegler's Beiträge, 1901, xxix., 233-249.

⁴ Virchow's Archiv, 1900, clxii., 501-514.

⁵ Ibid., 1901, clxiii., 287-303.

of necrosis the bone cells enlarge, their processes become visible, and in many places adjacent cells appear to coalesce. A little later the tissue in the Haversian canals shows well-marked evidences of proliferation. Multinuclear giant cells arise, which cause absorption of the adjacent bone substance and destroy by phagocytosis some of the bone cells thus set free. Other bone cells appear to be incorporated in the granulation tissue of the Haversian canals, from the cells of which they are not distinguishable. Resorption of bone is associated with new formation of bone. Sometimes the new bone is deposited directly upon the necrotic. Appearances occur that indicate that osteoclastic giant cells may subdivide into uninuclear osteoblasts—an observation also mentioned by von K  lliker.

Coenen¹ shows that the suppurative (sterile) pleuritis that follows the injection of sterile emulsions of "aleuronat" into the pleural cavity of rabbits runs a rapid course, exudation reaching its height on the second day. The leucocytes are almost exclusively pseudo-eosinophilous, and contain both oxyphile and basophile granules. Absorption and healing take place without the formation of adhesions.

RANVIER'S CLASMATOCYTES. Schreiber and Neumann² in a brief note point out that Ranvier's clasmatocytes are identical with Ehrlich's mast cells in staining reaction, morphology, and occurrence.

NORMAL OCCURRENCE OF PLASMA CELLS. Jolly³ found numerous plasma cells about the vessels of the normal omentum of the rat, the dog, the guinea-pig, and the rabbit. This demonstration offers a favorable field for the study of these cells, whose nature so far has not been definitely determined.

Regenerative and Proliferative Processes. **HUMAN GRANULATION TISSUE.** Georg Reinbach⁴ describes the structure of different kinds of human granulation tissue. He finds that the literature contains no special investigations concerning the pathological anatomy of various forms of abnormal granulations of human wounds. Pathological granulation tissue is divided into specific (tuberculous, syphilitic, actinomycotic, diphtheritic) and non-specific. The latter only are considered at this time. The most frequent are those forming in association with foreign bodies of various kinds, such as sequestra, etc. They are often seen about fistulous openings, and consist of exuberant, fungoid masses, pale, often glassy, and cedematous, the surface being smooth and velvety. They differ essentially from normal granulation tissue, being built up of capillaries, cellular and fluid inflammatory exudate, the fluid

¹ Virchow's Archiv, 1901, clxiii., 84-107.

² Centralbl. f. allg. Path. u. path. Anat., 1901, xii., 593, 594.

³ Soc. de Biol., 1900, lii., 1104-1105.

⁴ Ziegler's Beitr  ge, 1901, xxx., 102-154.

parts predominating. The young fibroblasts perish early. From the neighboring tissue fine vessels may grow out over the surface in the form of a pannus. The physical and chemical conditions leading to this form of granulation tissue, and directly dependent in their turn upon the presence of some foreign body, are not clearly understood. Other forms of abnormal granulations are seen after the evacuation of acute abscesses, when the surface for a time is covered with fibrinous inflammatory exudate and in the formation of croupous membranes upon the surface of granulating wounds. Healthy normal granulations present an uneven granular surface, a certain degree of elasticity, a surface that is easily cleansed, moist, and transparent, the color generally being red, the proliferation only extending to the level of the surrounding skin.

Jürgelūnas¹ comes to the following results from investigation of the passage of pathogenic bacteria through granulation tissue: Aseptic, uninjured granulation tissue acts mechanically as a barrier for the passage of bacteria into the body of the animals. Bactericidal properties of the cells of the granulation tissue and phagocytosis also act as protection against infection in susceptible animals. The bacteria do not show much alteration when placed on granulating wounds of susceptible animals, but are found greatly altered when placed on wounds of immune animals. The secretions from the granulating wounds of immune animals possess bactericidal properties for bacteria, to which the animals are immune. These bactericidal properties, however, depend entirely upon the strength and height of the immunity, the kind of infection as well as the kind of animals infected. Animals which do not die from the anthrax bacillus when the latter is placed on granulating wounds may rapidly succumb when the bacilli are placed on fresh wounds of the same animal. The character of the dressings of wounds has no influence on the result of the infection, while it greatly influences the healing process of the wounds.

ELASTIC TISSUE. The opinion that mechanical conditions alone lead to the formation of elastic fibres—that pressure and stretching lead to a direct change of collagenous tissue into elastic—is not supported by recent investigations of Jores² and others. These show that new elastic fibres develop from old. The regenerative powers of elastic elements are not far behind those of ordinary fibrous tissue. Not only are new fibres formed, but also plates and lamellæ, as in new-formed arterioles. The functional capacity of regenerated elastic tissue is difficult to determine. Elastic fibres do not form in granulation tissue; they appear

¹ Ziegler's Beiträge, 1901, xxix., 92-102.

² Verh. Deutsch. path. Gesellsch., 1900, iii., 1-9. Centralbl. f. Path., 1900, xi., 705, 706.

when fibrous tissue begins to develop. Sclerosis of fibrous tissue does not favor the growth of elastic elements, which have not as yet been found in keloids. Elastic fibres form in arteritis between two ligatures and in the substitution of thrombi where mechanical causes for its development are not apparent; this is also the case in the renal glomeruli, in the canals of the testicle, and in certain tumors. The exact relation of young elastic fibres to cells has not yet been worked out.

In a preliminary contribution on the nature and distribution of the new tissue in cirrhosis of the liver, Flexner¹ states that in all forms of cirrhosis the white fibrous tissue is increased. Along with the increase of this tissue there is new formation of elastic tissue from the adventitia of the vessels and the hepatic capsule. In all forms of cirrhosis both white fibrous and elastic tissue may penetrate into the lobules along the capillary vessels and the reticulum. In hypertrophic cirrhosis there is less interlobular and a finer and earlier intralobular growth. The reticulum becomes thickened.

R. M. Pearce² finds that in chronic passive congestion the increase in density of the lungs is due to newly formed elastic tissue. The elastic tissue is increased in the finer structures of the lungs; in marked cases there is increase also in the pleura, intrapulmonary septa, bloodvessels, and bronchi. The increase is progressive, and would tend to strengthen the walls of the air-passages, support the vessels, and prevent collapse of the air-cells.

B. Grohé³ gives an historical review of the development of the knowledge of elastic fibres. He finds that in fractures in rabbits there is new formation of elastic fibres both in the external callus as well as in the medullary.

GLIA TISSUE. Bonome,⁴ in an extensive article on the structure and histogenesis of pathological neuroglia tissue, points out that in pathological conditions, especially in gliomata, the neuroglia assumes characteristics which belong to fibrous tissue rather than to epithelial tissue. The fibres tend to accumulate around the vessels; it replaces destroyed nervous elements. He succeeded, however, in finding islands of neuro-epithelium within gliomatous proliferations. In embryonal glia cells the relations of the fibres to the protoplasm are often very intimate. There is marked chemical difference between glia fibres and connective-tissue fibres, as shown by the tendency of the former to soften and of the latter to sclerosis and calcification.

¹ Proceedings of the Path. Soc. of Philadelphia, 1900, iv., 9-17. Trans. Assoc. of Am. Phys., 1900, xv., 522-531.

² Journal of Medical Research, 1901, vi., 258-263. Univ. of Penna. Med. Bulletin, 1901, xiv., 228-230.

³ Münchener med. Wochenschrift, 1901, xlviii., 1555-1560.

⁴ Virchow's Archiv, 1901, clxiii., 441-497.

THE REACTION OF THE MYOCARDIUM, ENDOCARDIUM, AND PERICARDIUM TO FOREIGN BODIES. This subject has been investigated experimentally by Oppel in Virchow's laboratory¹ by means of aseptic needles. He finds that in the myocardium the resulting granulation tissue contains cells of myogenic origin produced by amniotic division of heart muscle cells. These new cells divide by way of mitosis. He found no evidence of any direct transformation of the young myogenic cells into connective tissue. Muscle and connective tissue are not transformed the one into the other, and the fate of the young muscle cells does not seem to have been settled, as the final scar consists of connective tissue only. He finds that the cells covering the epicardium have great proliferative capacity, and that they divide in such a manner as to cover the surface of the blood-clot that is deposited on the wound. Similarly, the endocardial cells cover the thrombus, which ultimately is replaced by fibrous tissue.

HEALING IN EPIDERMIS. H. von Bardeleben,² from a study of healing in the epidermis, points out that the first new cells for covering the loss are produced by mitosis in the deeper or germinal layers of the stratum Malpighii. As these cells multiply they are pushed in the direction of least resistance—*i. e.*, into the defect—which in a short time is filled with cells. The energy which pushes the cells in this manner is referred to as the kinetic energy of indirect cell division.

Leo Loeb³ discusses growth of epithelium, which he is studying experimentally. He shows that it is possible to separate growing epithelium from other tissues, as the epithelial cells grow without being in direct connection with other tissues. This renders it possible to subject epithelium to experimental conditions, *e. g.*, the action of chemical substances. Further work is in progress.

REGENERATION IN RUPTURE AND INFARCTION OF LIVER. Heile⁴ studied the changes about a large rupture of the liver ten days after its occurrence. There was an anæmic necrotic infarct of the liver, produced by the simultaneous rupture and closure of corresponding branches of the portal vein and hepatic artery at the bottom of the rupture. At the borders of the infarct regenerative processes were going on in the form of proliferation of the biliary epithelium, which showed numerous mitoses as well as amitotic giant-cell formation, and of the neighboring hepatic cells, which also showed mitoses, cells with two or more nuclei, and genuine giant cells. The amitotic processes were most marked nearest the border of the infarct. New connective

¹ Virchow's Archiv, 1901, clxiv., 406-436, and clxv., 1-14.

² Ibid., clxiii., 498-550.

³ Journ. of Am. Med. Assoc., 1901, xxxvii., 1024, 1025.

⁴ Ziegler's Beiträge, 1900, xxviii., 443-460.

tissue was also forming in the lobules near the rupture. The literature on hepatic infarction after rupture—apparently a rare condition—and on regeneration of the liver is discussed.

TRANSPLANTATION OF THYROID. Christiani¹ shows that grafts of the thyroid gland implanted in animals of the same species maintain their vitality and grow into permanent organs of the same structure and the same function as the primitive thyroid.

TRANSPLANTATION OF OVARIES. Schultz² succeeded in transplanting ovaries of rabbits into the peritoneal cavity of male rabbits, the germinal epithelium and primordial follicles remaining distinct for four months, the results in the main corresponding with those obtained by transplanting ovaries from female to female rabbit (Knauer, Gregorieff, Ribbert).

BONE FORMATION IN THE LUNGS. Pollack³ publishes an extensive research on bone formation in the lungs which has led to interesting and unexpected results. In about 18 per cent. of all bodies examined post-mortem he found very hard, yellowish masses, usually about pea-size, which in almost every case (17 per cent.) contained typical bone with medullary spaces. These formations arise through metaplasia of newly formed connective tissue around calcified, necrotic foci of undoubted tuberculous nature. The familiar whitish, cretaceous foci in the lungs form early stages in the production of the more yellow osseous. Similar ossifications he also found in the peribronchial lymph glands. They occur also in the pleura.

Lubarsch⁴ notes that these observations, coupled with others, such as of bone formation in the pia, in arterio-sclerosis, in laparotomy wounds (Askanazy), in cystitis (Morpurgo), go to show that bone may arise in connective tissue far away from normal bone, and that the presence of calcareous salts probably plays an important rôle. Barth⁵ saw beginning bone formation after introducing bone-ash into the peritoneal cavity of cats.

Rosenstein⁶ found true bone and cartilage in a calcified heart valve, and Rohner⁷ found true bone, with marrow, in calcified endocarditic and endarteritic foci.

I would suggest that in the case of the lungs especially, the lodgement of emboli of bone-marrow cells—probably a relatively frequent occurrence—may result in the growth of small foci of true bone tissue.

¹ Journ. de Phys. et Path. gén., 1901, iii., 22-26.

² Centrabl. f. allg. Path. u. path. Anat., 1900, xi., 200-202.

³ Virchow's Archiv, 1901, clxv., 129-187.

⁴ Centralbl. f. Path., 1900, xi., 715, 716.

⁵ Berl. klin. Wochenschrift, 1896, xxxviii, 9.

⁶ Virchow's Archiv, 1900, clxii., 100-114.

⁷ Ibid., 1901, clxvi., 13-40.

Retrogressive Changes. EXPERIMENTAL CALCIFICATION. Von Kóssa¹ studied calcification as it occurs in the cortex of the kidney of the rabbit after intoxication with a variety of substances and after ligation of the renal vessels (Litten). There are several inorganic and organic substances that have a calcific action on the kidney in rabbits, which are especially susceptible, and other animals. Aloin, corrosive sublimate, and acetate of lead are especially characterized by this effect in rabbits. Kóssa finds that copper sulphate, iodine, and iodoform also cause calcification. The causes of calcification depend, in the first place, on the changes produced by the calcific agent on the tissues, and then the quantity of Ca in the blood. The calcification occurs especially in the cortex, and of its structures the convoluted tubules are singled out. Kóssa found by analysis that the amount of calcium salts in the skeleton is not diminished in poisoned animals, but that there is a fall in the elimination of calcium compounds in the urine; hence he concludes that the kidney under the influence of aloin and other substances is unable to excrete the lime-salts normally brought to it by the blood. These salts are then deposited in the convoluted tubules. The causes of diminished excretion are undetermined. Attention is called to the affinity between lime-salts and dead albumin, but not every focus of coagulation necrosis in the kidney becomes calcified.

Kischensky² describes the lesions in a case of extensive calcification of the lungs and stomach of a woman, aged forty-two years, in which there was no disease of the skeleton (as urged by Virchow in his explanation of "calcareous metastases"), but a marked chronic nephritis. Similar cases from the literature are reviewed. In Kischensky's case the calcification involved especially the walls of the capillaries and smaller vessels, whence the process spread to other parts. In the lungs some fragmentation of the elastic fibres was found similar to that described by Davidsohn (see PROGRESSIVE MEDICINE for March, 1901, p. 347). The cause of the calcification is not understood.

THE NATURE OF FATTY CHANGES. Hester³ discusses the processes that underlie the formation of fat in the tissues. In order to make clearer what happens in the deposition of fat in the cells he made a number of injections of pure olive oil into the muscles of rabbits, and studied the subsequent fate of the oil globules. In the case of normal muscle the fat disappears wholly in two days. When the injections are repeated and prolonged there is more or less cellular infiltration, the cells of which contain fat; fat is also found in the cells of the fascia and subjacent muscle. By tenotomy, neurotomy, section of muscle, and by compression, conditions were established that led to

¹ Ziegler's Beiträge, 1901, xxix., 163-202.

² Abstr. from Russian in Centralbl. f. allg. Path. u. path. Anat., 1901, xii., 674-676.

³ Virchow's Archiv, 1901, clxiv., 293-343.

delayed resorption of fat. The sum and substance of the results of these experiments may be stated thus: Muscle cells, the cells of the fascia, the cells of an infiltration, and the medullary sheaths of nerves contain fat after they have remained for a time in the immediate vicinity of fat droplets. From a study of the appearances in the fatty cardiac muscle and the fatty muscle of exophthalmic goitre the conclusion seems unavoidable that fat enters the muscle not as fat, but split into its constituents; the splitting taking place in the fluids of the tissues, the building up in the cells. The fat is never found in so small drops outside as within the cells, and in the skeletal muscles even the small drops could not enter the muscle substance through the sarcolemma. The fat is dissolved as soap by the cedematous fluids and absorbed. In this condition it is taken up by the cells and built up again into fat.

Fatty degeneration is the result, then, of an increased importation of fluids with dissolved fats, due to circulatory disturbances, and depends on synthesis in the cells. Hester assumes that the fat-splitting ferment in the serum is lipase, and that all cells have the power of synthesis of fat. I would point out that recently Kastle and Loewenhardt have shown that the action of lipase is reversible—i. e., if added to a mixture of fatty acid and glycerin the two are united and fat is formed. It is therefore not unlikely that the enzyme also causes the synthesis which Hester finds occurs in the cells. The question of the reversibility of enzymes and its application to physiological and pathological processes is discussed by H. G. Wells¹ in an article which appeared while this report was going through the press.

Paulain² notes that the quantity of lipase in the lymph nodes, more especially the mesenteric, diminishes in local and general infections.

Sata³ has studied by means of sudan III. the presence and the distribution of fat in pathological tissues. Fat occurs uniformly in the vicinity of necroses; in tuberculous foci fat is found, especially at the borders of the caseation. This fat appears after the necrosis has taken place. The exact source of the fat is not clear—whether it is formed from the protoplasm of necrotic cells or by changes in the living cells near by, due to chemical substances in the necrotic area. To what extent tubercle bacilli play any direct rôle in its production in tuberculosis is also unknown. Sata found fat quite constantly in the cells of the thyroid and in carcinoma cells.

AMYLOID CHANGES. Alan B. Green⁴ produced experimental amyloid degeneration by means of repeated injections of staphylococcus

¹ Journal of American Medical Association, 1902, vol. xxxviii., p. 220-223.

² Comp.-rend. de Soc. biol., 1901, liii., 786, 787.

³ Ziegler's Beiträge, 1900, xxviii., 461-478.

⁴ Journ. of Path. and Bacteriol., 1901, vii., 184-202.

pyogenes aureus into rabbits, mice, and chickens. In the rabbits and mice hyaline changes developed quite constantly, but amyloid degeneration was not obtained in these animals. In fowls, however, amyloid material was produced in nearly all instances, often closely associated with hyaline changes. Experimental amyloid material differs from the human by refusing to give the characteristic color reactions after immersion in alcohol or other strong hardening fluids for a few days. In animals amyloid degeneration is much more of an acute process than in man, in whom it rarely develops sooner than within a few weeks. In animals it may develop in perhaps one or two weeks. Green was not able to verify Petrone's conclusion that amyloid material is derived from altered blood pigment. It is probable that Petrone mistook for amyloid, mucoid and other changes in the tissues. There are many points of resemblance between amyloid change and hyaline change, and Green concludes that hyaline degeneration is a forerunner of the acute amyloid change in fowls, and that in rabbits and mice the hyaline degeneration present may be regarded as an early form of amyloidosis. Injections in hens of peptone solutions also resulted in amyloid changes and a definite increase of eosinophile cells in the blood, as was the case also with the animals treated with staphylococcus aureus. An experiment is cited showing that antistaphylococcic serum may prevent the development of amyloid and of eosinophilia in chickens when injected with staphylococci. The last form of experimentation should be carried out on a larger scale.

Tarchetti¹ produced subcutaneous abscesses in dogs by repeated injections of turpentine extending over a long period. Amyloidosis did not result by hyperplasia of the spleen and lymph glands.

Ophüls² describes amyloid substance and amylaceous bodies in multiple syphilitic growths of sternum, ribs, and spine. The presence of connective tissue in the inner layers of the growths is regarded as evidence of their granulomatous nature. Numerous amylaceous bodies were present, consisting of a central, homogeneous mass, apparently derived from degenerating cells, and crystalline needles in the periphery. Crystalline amyloid substance has been described by Maximow in experimental amyloid degeneration. Ophüls discusses the literature on amylaceous bodies, and reaches the general conclusion that they are composed of amyloid substance in crystalline form.

HÆMOCHROMATOSIS WITH ATROPHY OF ADRENALS. In two cases of diffuse hæmochromatosis with advanced cirrhotic changes in the internal organs and brown pigmentation of the skin, which resembled

¹ Clinica medica ital., 1900. (Abstr. Centralbl. f. Path., 1901, xii., 300.)

² Journal of Experimental Medicine, 1900, v., 111-130.

the skin in Addison's disease, Pio Foa¹ found marked atrophy of the adrenals. As in Opie's² case, there was no diabetes in these cases, at least not in one of them. Foa regards the changes in the adrenals as secondary to the process that destroyed the red blood cells, but it is interesting to note that by the injection of adrenal extract Foa saw marked absorption of red corpuscles by phagocytic cells, especially in the spleen and abdominal lymph glands.

In another series of experiments there developed infarcts in the kidneys and intestines, hemorrhages and exudate in the lungs, and pigmented cirrhosis of the liver. It is thought that this substance that causes coagulation and necrosis is a nucleo-albumin different from the one that raises the vascular pressure.

NECROSIS IN THE LIVER. Mallory³ distinguishes two forms of necrosis in the liver, the central, beginning in the centres of the lobules and spreading peripherally, and the focal, of irregular distribution. The central form does not seem to have been recognized as a distinct type, as Mallory found no reference to it in the literature. It occurs chiefly in the acute infections. The bacteriological examination indicates that the streptococcus is more frequently concerned than any other bacterium. It is recognizable with great difficulty by the naked eye, presenting the general picture of chronic passive congestion, with small fat drops in the liver cells. In marked cases the necrosis may extend out to within three or four cells of the portal vessels; the areas always involve the central parts of the lobules. The cells become acidophilic, the cytoplasm vacuolated, containing hyaline globules and fibrinous threads. Later, invasion with polynuclear leucocytes and endothelial cells occurs. Eventually the cells appear as hyaline masses undergoing disintegration. Serous and more rarely hemorrhagic exudation may appear between the cells. The vessels in the necrotic area nearly always contain fibrin. Mallory succeeded in producing this form of necrosis by injecting rabbits with large doses of diphtheria toxin. The explanation of the location of the necrosis is not quite clear, but probably many factors are concerned, more particularly cardiac lesions, which were present in a large number of cases, and the poorer nutrition of the central cells as compared with those of the margins of the lobules. It seems probable that the central necrotic areas may become replaced with fibrous tissue.

Focal necrosis in the liver may arise in three ways, according to Mallory: around bacteria, by occlusion of capillaries with phagocytic cells, and by thrombosis of capillaries. They are not infrequent in

¹ *Verh. Deutsch. path. Gesellsch.*, 1900, iii., 31-40.

² *Journal of Experimental Medicine*, 1899, iv., 279-306.

³ *Journal of Medical Research*, 1901, vi., 264-280.

tuberculosis of the liver.¹ They are seen also around other bacteria, such as the streptococcus. In typhoid fever necrosis due to capillary occlusion by cells is frequent. Mallory succeeded in producing focal necroses in the liver by injection into the mesenteric veins of lycopodium spores, carmine, and charcoal, around which thrombi formed in the intralobular capillaries; and also by injection of diphtheria and other toxins, when there appeared phagocytic cells in the capillaries. By massage of the spleen and by the electric current he set free phagocytic cells normally in the splenic sinuses, and found necroses in the liver; but it seems that focal necroses are not infrequent in the livers of normal guinea-pigs, so that this animal is not suited for this kind of experiment. Under all circumstances many focal necroses may be regarded as miliary infarctions caused by cell emboli and by capillary thrombosis.

Phagocytosis of Nerve Cells. Based upon the study of the cellular elements in the adventitia of the cerebral vessels in general paralysis, John Turner² concludes that some of these cells are phagocytic and destroy nerve cells; even normal cells are said to be attacked. The histological details of the adventitial proliferation and the exact nature of the phagocytal cells require further study; eosin and methylene blue preparations ought to yield instructive pictures. I think that it is not unlikely that some of the cells described by Turner as multinuclear cells with daughter cells are phagocytic endothelial cells.

Marinesco³ has described phagocytosis of the altered neurocytes in experimental botulismus, the phagocytes or neuronophages being regarded as glia cells. Kempner and Pollack⁴ failed to confirm this observation. Ossipoff⁵ studied this question in guinea-pigs, cats, and monkeys, using for injections a toxin of van Ermengen's bacillus botulismus. The symptoms are characteristic, largely of a nervous type, and resemble much those in human botulismus. Profound alterations were found in the vessels and in the neurocytes, phagocytosis being a prominent feature, and in this leucocytes also certainly take part. In this case phagocytosis does not appear to begin until after the neurocytes have been stricken by the toxin.

Somewhat similar changes occur in the intervertebral ganglia (Nelis and van Gehuchten) and about the spinal and bulbar motor centres (Babes) in rabies. The value of these changes in the rapid diagnosis of rabies are discussed by Ravenel and McCarthy.⁶ Ravenel⁷ ends a

¹ See Le Count, *Journal of Experimental Medicine*, 1897, 657-670.

² *Journ. of Path. and Bacteriol.*, 1800, vii., 79-89.

³ *Soc. de Biol.*, 1896, xlviii., 989-991. *Presse Médicale*, 1887, No. 8.

⁴ *Deutsch. med. Wochenschrift*, 1897, xxiii., No. 33.

⁵ *Ann. de l'Institut Pasteur*, 1900, xiv., 769-793.

⁶ *University Medical Magazine*, January, 1901. *Proceedings of Path. Soc. of Philadelphia*, 1901, iv., 89-102.

⁷ *Buffalo Medical Journal*, May, 1901.

further consideration of the subject as follows: "1. When present, the capsular and cellular changes in the intervertebral ganglia, taken in connection with the clinical manifestations, afford a rapid and trustworthy means of diagnosis of rabies. 2. That when these changes are not present it does not necessarily imply that rabies is not present. These lesions afford contributory evidence more or less valuable, depending on the duration of the clinical manifestations. 3. That in certain cases when the capsular changes are slight, such as in animals dying or killed in the early stages of the disease, the changes are more marked in the disto-peripheral end of the ganglion. 4. That the rabic tubercle of Babes is present sufficiently often to furnish valuable assistance in cases where only the central nervous system is obtainable without any of the ganglia, but in cases where the ganglia can be had, they offer a simpler and easier method of diagnosis than do the brain or cord themselves."

Bailey,¹ in an elaborate article on the morphology of the nerve cells in the rabbit, including the changes in rabies, concludes his review of the literature on the latter topic as follows: "It would appear, therefore, as stated by Crocq,² that, while no lesion specific for rabies has been discovered, the totality of the lesions, both those emphasized by Babes and those described by van Gehuchten and Nelis, makes a picture sufficiently characteristic to warrant the usual diagnosis of rabies when all of the circumstances of the case are considered. The absence of these lesions does not, however, exclude rabies."

Spiller³ points out that lesions similar to those of rabies may occur in other conditions. In an endothelioma of the Gasserian ganglion he found proliferation of the capsular cells and complete destruction of the nerve cells. In Landry's paralysis he has also seen changes very much like those of rabies. From the observations of Spiller and others I think that too much faith must not be placed in the absolute specificity of the nervous lesions of rabies, particularly in the absence of definite clinical data.

Effects of Bacterial Toxins on Peripheral Nerves. Dopter and Lafforgue⁴ injected various bacterial toxins into the sheath of the sciatic nerve without injury to the nerve itself, and found that in the guinea-pig the poisons are absorbed into the nerve at the most vulnerable point, namely, the constrictions, where the toxic action becomes manifest by necrosis of the medullary sheath and eventually of the

¹ Journal of Experimental Medicine, 1901, vi., 549-616.

² See Les lésions anatomo-pathologiques de la rage sont-elles spécifiques. Journ. de Neurologie, 1900, v. 241.

³ University Medical Magazine, January, 1901.

⁴ Arch. de Méd. exp. et d'Anat. path., 1901, xiii., 517-538.

axones, in which case typical Wallerian degeneration follows. In its early stages the lesion is confined to the "interannular periaxial segment." These results suggest that peripheral neuritis of infectious origin is caused by the action of bacterial substances passing by dialysis from the bloodvessels into the nerves.

TUMORS.

The most striking recent events in this field of investigation are the announcement from two different sources that the cause of cancer has been discovered. I refer to the publications of Gaylord,¹ from the New York State Pathological Laboratory at Buffalo, and of Max Schüller,² of Berlin. At the same time the literature has been enriched by a number of solid, though less startling contributions, and there is no sign of abatement in the interest in tumors in general and especially in the etiology and treatment of carcinoma and sarcoma. In Germany there has been organized a committee for the investigation of cancer, supported by funds from the government and from various societies.

Gaylord's Protozoon of Cancer. Dr. Gaylord, the director of the New York State Laboratory, has announced that the cause of cancer is an animal parasite. The article containing the evidence upon which this announcement is based is devoted largely to a description of the appearances of the microscopical sections of tissue prepared according to various methods in an effort to show that "Plimmer's bodies," Russell's fuchsin bodies, and the forms regarded by Sjöbring, Eisen, and others as protozoa are identical with the animal organism which Gaylord claims is the cause of cancer. Gaylord regards his organism as a protozoon, and not as a blastomyces, principally because an elaborate series of culture experiments with tumors failed to disclose the presence of blastomycetes. Similar forms are described in a variety of other processes (syphilis, leukæmia, etc.), and should Gaylord's foreshadowing prove true we are on the verge of a protozoic era in etiology. If there is any organism in carcinoma present it must be cultivated and the disease produced with pure cultures of this organism; and it is at this crucial point that the chain of evidence presented by Gaylord crumbles. Gaylord injected peritoneal fluid from a case of peritoneal carcinoma into the jugular vein of a guinea-pig, which when killed had numerous adenocarcinomatous nodules in the lungs. In this fluid were numerous amœboid bodies, which are described as passing through

¹ Am. Journ of Med. Sci., 1901, cxxi., 503-539.

² Die Parasiten im Krebs und Sarkom des Menschen, Jena, 1901.

a decidedly peculiar cycle of development up to an apparent spore-forming stage. Granting that the nodules in the guinea-pig's lungs were carcinomatous, it must be remembered that the peritoneal fluid injected does not represent a pure culture of a definite organism. It may have contained viable carcinoma cells, and also various substances produced by disintegration and other changes in the peritoneal carcinoma. Hence, if the pulmonary nodules in the guinea-pig developed in response to the injection of the fluid, it is quite impossible to say which was the particular factor that caused epithelial proliferation; and, as pointed out by Schüller,¹ the use of peritoneal fluid is open to the further criticism that intestinal contamination may have taken place. Cultures were not obtained of the "organisms" seen in the peritoneal fluid. Later, successful culture experiments were made; but, unfortunately, sufficient detail is not given in this article. Perhaps the more complete article, held in reserve, will solve many of the obscure points that, for the present at least, are of such weight as to fully justify the statement of Welch,² Cullen,³ Fisch,⁴ and others that the cause of cancer is still an unknown factor. The statement of Gaylord that the blood of cancer patients contains a large number of parasites might lead to the erroneous inference that cancer, being a blood disease, its removal is useless. In the early stages carcinoma is a purely local process, which may be permanently cured by surgical treatment. The importance of this doctrine cannot be overestimated, because it contains the only chance at present known to escape death from cancer once developed. Roswell Park,⁵ in an article of a general character, upholds strongly the specific etiological importance of the organisms described by Gaylord and Schüller, but denies all justification for the slightest change in the existing methods for the treatment of cancer.

Schüller's Parasites of Carcinoma and Sarcoma. In *PROGRESSIVE MEDICINE* for March, 1900, I referred to the protozoic parasites described by Schüller in malignant tumors. Since then he has published a more complete monograph (128 pages, with numerous illustrations), embodying the principal results of his investigations. The particular feature of his methods is the way in which he obtains what he calls pure cultures, namely, by keeping absolutely uncontaminated pieces of malignant tumors in small, air-tight glass vessels, protected from light at the temperature of the body from the very moment the fragments

¹ *Centralbl. f. Bacteriol.*, 1901, xxx., 29-31.

² *Bulletin of Johns Hopkins Hospital*, 1901, xii.

³ *American Medicine*, 1901, i., 298, 299.

⁴ *St. Louis Medical Review*, May 25, 1901, 366, 367.

⁵ *Journ. of Am. Med. Assoc.*, 1901, xxxvi., 671-674. *Medical Record.*, 1901, lix., 761-767.

are removed. The tissue itself is the nutrient substratum, which is soon consumed by the multiplying organisms within it. These organisms have a peculiar morphology, and are provided with a ferruginous pigment of golden-yellow or brownish color, and a thin, doubly contoured capsule, through pores in which cilia pass out. Subcultures have not yet been secured, and the complete biology of the parasite has not been worked out. There are but minor differences between the parasites obtained from carcinoma and sarcoma. Schüller himself states that the best zoological and botanical authorities of the University of Berlin have declared themselves ignorant as to the nature of the peculiar structures described. Until further observations are made it would be quite useless to speculate as to their probable nature. They are easily demonstrable by their color in tissues prepared by teasing in alcohol and clearing with oil; and Schüller finds them very numerous in metastases, especially at the margins, where appearances are seen which indicate that under the influence of the formative stimulus of the parasites, carcinoma cells originate from the cells of the glands or of the connective tissue, according to the old theory of Virchow, long since abandoned. In many tumors the parasites seem to enter from without, indicating a more resisting form or stage than those found within the tumors, but no facts are presented to prove this to be the case. Still, Schüller makes this the basis for a detailed discussion of the prophylaxis of tumors. The animal experiments are not described with enough detail. Necrotic and inflammatory lesions and carcinomatous and sarcomatous proliferations are described as resulting from inoculations of the cultures. We are not told whether the rabbits experimented upon died spontaneously or not; the permanency of the new proliferations, many of which are of anomalous structure, *e. g.*, proliferations with epithelial pearls originating in the kidney, is not established. In order to prove that an organism is the cause of sarcoma or carcinoma it is necessary to isolate the organism in pure culture and to produce the corresponding tumor in another animal by inoculating the organism. As long as Schüller has not secured subcultures of his parasites we cannot say that he has worked with pure cultures; and there is also room for doubt as to the results of inoculations—the resulting proliferations may all have been of a granulomatous character.

Roswell Park¹ claims that Schüller's parasites are identical with those described by Gaylord, nearly every statement being corroborated, he says; but I do not see, from reading the respective descriptions, how such a conclusion is possible. Gaylord identifies his parasites with Plimmer's bodies, while Schüller expressly states that his parasites are

¹ Loc. cit.

wholly different from Plimmer's bodies. Schüller himself, in a review¹ of Gaylord's article, points out some of the more striking differences between Gaylord's protozoa and his own parasites, which, he remarks (page 31), do not belong to protozoa. Perhaps the most fundamental difference is the resistance to changes of temperature on the part of Gaylord's organisms, which resist desiccation, as compared with the extreme sensitiveness of Schüller's. If the organisms or bodies studied by Gaylord and Schüller are not identical, it is evident that they cannot both be the sole cause of cancer. In view of this fact alone it is not necessary at this time to further discuss the many questions that suggest themselves, but to await calmly further developments.

Since the foregoing was written, Hauser² and Völcker³ announce that Schüller's supposed parasites are nothing more than cork cells. Schüller⁴ denies the possibility that the bodies he describes are of this nature. Hauser also disagrees with Schüller's diagnosis of many of his specimens.

Blastomycetes in Carcinoma. At the Ninth German Gynecological Congress (Giessen, May 29-31, 1901), Leopold⁵ reported upon his investigations into the origin of malignant tumors. His methods and previous results are given in *PROGRESSIVE MEDICINE* for March, 1901, p. 353. He has now obtained eight identical cultures of blastomycetes from eight tumors, especially ovarian carcinomata. Implantation of human carcinomatous tissue into the abdomen of animals has given the following results: In two rats ovarian carcinoma gave in one a walnut-sized adenosarcoma, in the other fibrosarcoma. In one rabbit carcinoma of the uterus produced "epithelial carcinoma" as large as an orange in the abdomen and metastases in the lungs. All these animals died spontaneously, the rabbit after four years and five months. The injection of cultures of blastomycetes obtained from human tumors produced in rats marked and numerous tumor growths of the character of round-cell and giant-cell sarcoma. Leopold concludes that blastomycetes are able to cause malignant tumors in animals, and are at least a cause of tumors in man. That they are the only cause he does not venture to claim.

Miscellaneous Articles Bearing on the Etiology of Carcinoma and Sarcoma. Rebrowsky⁶ concludes an extensive research of the intracellular inclusions in carcinoma to the effect that the protozoa-like bodies in carcinomata are secondary formations.

¹ Centralbl. f. Bakteriöl., 1901, xxx., 29-31.

² Editorial, *American Medicine*, October 5, 1901.

³ Deutsch. med. Wochenschrift, 1901, xxvii., 494.

⁴ Centralbl. f. Bakteriöl., Abth. I., 1901, xxx., 335, 336.

⁵ Report in Centralbl. f. allg. Path. u. path. Anat., 1901, xii., 636.

⁶ Centralbl. f. Bakteriöl., Abth. I., 1901, 101-105. (Abstract of an investigation in the Russian language, 190 pages long.)

De Meser¹ found lycopodium spores in the interior of an ulcerated carcinoma of the skin which had been dusted with some form of dusting-powder containing lycopodium. With this observation as a basis he emphasizes the possibility of the entrance from without into pre-existing carcinomata of substances that might be mistaken for bodies seemingly of etiological import. Wyssokowitsch² found that the injection of lycopodium spores into the subcutaneous tissue of rabbits produces absorbable swellings composed of granulation tissue with giant cells.

Olt³ reviews the whole subject of the etiology of carcinoma. He made culture experiments on a number of media with material from various carcinomata in the horse and dog, but with uniformly negative results. He believes that many of the so-called carcinoma bodies are changed red blood cells that have been taken up by the epithelial cells. Many of these bodies occur especially near small hemorrhages, and they give the iron reaction.

Svatchenko⁴ shows by means of special staining methods that intracellular bodies in tumors (fibroma) may be of the nature of elastin, produced probably by the abnormal chemical or functional processes within the cells. He suggests that many of the cellular inclusions of tumors may be the result of abnormal processes of the cells.

Marnock⁵ buried bits of epidermis in the tissues in the same manner as Kaufmann, who obtained small cysts, but in Marnock's experiments all the epidermal fragments died within a few days. In neither case did carcinomatous growths develop. Mere displacement of the epithelium does not endow it with the property of limitless growth and penetration into surrounding parts.

Isaac Levin⁶ made a number of experiments, with the object of freeing the cells from the influence of the rest of the organism, in order to determine whether this removal of tissue tension would lead to cell proliferation, but the experiments gave only negative results. He favors the view that direct stimuli produce proliferation.

Borrel⁷ reviews critically the various parasitic theories of cancer. There is as yet no proof positive of the correctness or incorrectness of either the coccidian or blastomycetic theory. The field is still an open one, in his opinion, and he would not prejudice the question by speaking of the "microbe of cancer," because of the likelihood that the various tumors included under this name may depend upon different causes.

¹ Virchow's Archiv, 1901, clxiii., 111-120.

² Ibid., 120-125.

³ Deutsch. tierärztliche Wochenschrift, 1900, xxii. and xxiii.

⁴ Arch. russes de Path., 1901, xi., 227-238.

⁵ Lancet, 1901, clxi., 6-10.

⁶ Journal of Medical Research, 1901, vi., 145-155.

⁷ Ann. de l'Institut Pasteur, 1901, xv., 49-67.

Roncali¹ supports vigorously the blastomycetic theory of tumors. He describes a sarcoma of the brain with an unusually large number of "blastomycetes."

V. Leyden² champions the protozoon theory of carcinoma based upon the morphological appearances within fresh cancer cells. He has also found amœboid forms in cancer juice and in the fluid of cancerous ascites.

Jürgens,³ of Berlin, found protozoa (sarcosporidia) in the bronchial secretion of carcinoma of the lung. While their relation to carcinoma is still uncertain, the observation shows that sarcosporidia may multiply freely in this part of the body; the multiplication is preceded by conjugation.

Nason⁴ believes in the parasitic theory, and suggests that the parasite enters by way of wounds or stings of insects.

The numerous contradictions indicated in the foregoing summary show plainly enough that there is as yet no single parasitic theory of tumors, malignant or not, upon which to base further successful investigations into their etiology and treatment.

Senn⁵ reviews the present status of the carcinoma question, his conclusion being that to claim a parasitic origin for this disease is not warranted at the present time.

Adami,⁶ in an interesting discussion concerning the causation of cancerous and other growths, dwells especially upon the many points of relationship between the various forms of tumors, both benign and malignant—a relationship so close that if we assume a parasitic cause for one class we must needs assume it for the other. Yet no one believes that teratomatous tumors, angiomas, and other benign forms are caused by parasites. The cause must be sought in various physical or toxic forms of stimuli of cell proliferation, the cells using the energy normally spent in catabolism for mitoses and cell division, proliferating processes replacing the functional, the continued automatic growth corresponding to a newly acquired "habit of growth."

C. P. White⁷ also discusses the general pathogenesis of tumors, the essentially new idea advanced being an amplification of Ribbert's theory, to the effect that in the growth of tumors the parts are in an unstable equilibrium due to constitutional causes, but he cannot say just wherein this unstable equilibrium actually consists.

¹ Fifteenth Congress della soc. ital. di chirurgia. Abstract in *Centralbl. f. Path.*, 1901, xii., 354.

² *Zeitschrift f. klin. Med.*, 1901, xliii., 1-11.

³ *Centralbl. f. Path.*, 1900, xi., 711.

⁴ *British Medical Journal*, 1901, i., 1199.

⁵ *Journ. of Am. Med. Assoc.*, 1901, xxxvii., 804-815.

⁶ *Yale Medical Journal*, March and April, 1901, vii.

⁷ *Journ. of Pathol. and Bacteriol.*, 1901, vii., 339-356.

In all these general discussions of the cancer question reference has not been made to the great rarity of primary malignant tumors of mixed carcinomatous and sarcomatous type. H. G. Wells¹ reports an instance of this kind in the thyroid of a dog. The metastases were in part mixed, in part purely sarcomatous, in part purely carcinomatous. He could find but two analogous cases in the literature, and both these were in the thyroid. Wells found, further, but seventeen cases in which the same individual was simultaneously afflicted with a primary carcinoma and a primary sarcoma. Nehrkorn² and Gruenfeld³ report instances of primary multiple malignant tumors, but neither has collected as many cases as Wells.⁴ This great infrequency of mixed and multiple primary malignant tumors would speak against the theory that tumor growth depends on "disturbed equilibrium" from general causes. Cohnheim's celebrated theory of "embryonal matrix" also falls short from this point of view, because most of such matrices that we know anything about contain epithelial and mesoblastic tissue, while the tumors usually are derived from only one kind of tissue. The theory that carcinoma and sarcoma are caused by different parasites agrees better with the great rarity of mixed malignant tumors, because whatever the cause or causes may be, a selective action is exercised upon definite cells, which maintain their specific characters during further growth. Did they not, mixed tumors would be common. Wlaeff⁵ holds that malignant tumors are essentially of the same nature, the varieties resulting from local and other conditions in the patient, but the infrequency of mixed and multiple malignant tumors would certainly speak against this view.

Lohmer,⁶ in a long list of carcinomata carefully examined by serial sections, failed to find any histological support for Ribbert's theory that the "primum movens" in carcinoma lies in the subepithelial connective tissue. He was forced to adopt the earlier views of Thiersch and Waldeyer, namely, that multiplication of epithelial cells alone is responsible for carcinoma.

The fact that there is but little real support for the parasitic theory of tumors has turned investigators again toward the old and rather indefinite irritation theory of Virchow. This theory looks upon tumor growth as the result of a primary disease of the cells that proliferate—in the case of carcinoma the epithelial cells—and this disease is the result of "irritation," such as may result from mechanical injury, pressure, continuous suppuration, inflammation, etc. Numerous ex-

¹ Journ. of Pathol. and Bacteriol., 1901, vii., 357-367.

² Münchener med. Wochenschrift, 1901, xlviii., 581-585.

³ Ibid., 1279-1284.

⁴ See also report by Warthin (Philadelphia Medical Journal, 1901, viii., 701-703) of sarcoma, adenocarcinoma, and myoma in the same man.

⁵ Vratel, July 6 and 13, 1901.

⁶ Ziegler's Beiträge, 1900, xxviii., 372-415.

amples are cited readily : Carcinoma of the smoker's lip, of the chimney-sweep's scrotum, of the gall-bladder when containing calculi, etc. ; psoriasis, fistulæ, leukoplakia, syphilis, tuberculosis, may all favor the development of carcinoma. These are processes characterized by cell multiplication especially. In many mucous membranes it may be quite difficult, if not impossible, to distinguish between carcinoma and certain chronic hyperplastic forms of glandular inflammation. This is emphasized strongly by Le Count¹ in a study of carcinoma of the Fallopian tube in its relation to chronic salpingitis. He shows that it may be impossible to draw a sharp line of distinction between carcinoma and inflammatory processes of this nature. In the case of the tube great confusion has arisen because glandular hyperplasia of the epithelial lining is often accompanied with *sactosalpinx*. He cites several instances of growths in tubes removed in the period of transition between hyperplasia and true tumor. It would seem as if any factor that causes cell proliferation may lead to carcinoma, and hyperplasia of various kinds may become the starting-point of carcinoma.

Brosch² dwells upon the importance of injury to parts the seat of reparative processes in furnishing the necessary stimulus to tumor growth. Bruising the skin of guinea-pigs so that a granulating surface formed, and then rubbing the latter with a solution of paraffin and xylol, caused an atypical epithelial proliferation quite like early carcinoma, but regional or general metastases are not reported. The word "irritation" does not convey any clear idea of the factors at work. It answers the useful purpose of designating a number of clinical and anatomical observations, but the chemico-physical factors that underlie the resulting cell proliferation cannot be grasped as yet. We need to be much better informed than at present concerning the fundamental factors of cell multiplication, its physics, and its chemistry ; and it may well be that it is along these lines that an insight is to be gained into the secrets of tumor growth.

Statistics in Regard to Tumors. Impressed with the value of statistical studies as a means of indicating the probable nature, parasitic or otherwise, of cancer, Lyon³ undertook a study of this kind for the city of Buffalo for the years 1880-1889. The questions of local foci, of so-called cancer houses, of race, of social habits, etc., in relation to cancer are interesting and important ; for when studied on a large scale some light, perhaps, would be thrown upon the probable nature of the disease. The principal facts obtained by Lyon after a careful investigation of the material presented are as follows :

¹ Johns Hopkins Hospital Bulletin, 1901, xii., 55-68.

² Virchow's Archiv, 1900, clxii., 32-84.

³ Am. Journ. of Med. Sci., 1901, cxxi., 629-651.

The house distribution of cancer (here used as synonymous for malignant tumors of all kinds) shows a marked concentration in the German wards. That this local concentration is connected with nationality is shown also by the race table, which shows cancer to be many times (4.59) more frequent among foreigners, especially Germans, than among the native born. The Germans and Poles show involvement of the stomach ten times more frequently than the native born, for equal numbers of each. This marked discrepancy tends, in Lyon's opinion, to support the parasitic theory "by supposing that the peculiar diet of the Germans is more liable to contamination with the parasite of cancer than the more ordinary diet of other classes," following Behla's hypothesis of infection through contaminated raw vegetables. Cancer of the uterus and breast is correspondingly infrequent in Germans—a little more than half as common as in the natives. The ratio of males to females was as 93 to 100 for Germans (including Poles), and from 51–61 to 100 for all other races and classes. For all classes the ratio of males to females was found to have risen during the twenty years covered by the study. The general cancer rate rose from 32 to 53 per 100,000 of population during these years. This increase is in part due to changes in the proportion of the foreign born.

The most striking feature of Lyon's figures is the disproportionate frequency of cancer of the stomach among the Germans and of cancer in general among the foreign born. If this receives corroboration from other sources, the frequency of gastric cancer among the Germans will become a matter of considerable importance. Assuming it to be true we may well ask, Does it depend upon the original constitution of the stomach (embryonal theory), or upon what is put into the stomach (parasitic theory)? Unfortunately, Lyon was not able to secure official statistics in regard to the frequency of cancer of the stomach in Germany. Lyon's statistics should stimulate to similar studies in other American cities, so that material would accumulate from which it might be possible to draw conclusions of more general importance.

CANCER IN MASSACHUSETTS. William T. Whitney¹ chose this as the subject of the Shattuck lecture, and the following is his recapitulation: 1. If death from cancer should go on at the apparent geometrical rate of increase of the past fifty years, in two and a quarter centuries every person over thirty would die from that disease. 2. This rate is probably only arithmetical at its worst. 3. The increase is probably due to better diagnosis and registration, and until the ratio of deaths over thirty years has reached 8 to 9 per cent., which is shown by autopsies to be the true rate of cancer, it is not justifiable to speak of the increase as adherent in the disease itself. 4. For purposes of

¹ Boston Med. and Surg. Journ., 1901, cxlv., 53–61.

comparison with other places or years a "graphic picture," composed of both the rate and ratio curves, covering the period over thirty years, divided into decades, is the best. 5. Comparison with other States and countries shows the rate for Massachusetts to be about the same as theirs, with greater variation between the males and females than is the case in Austria, which is remarkable for the correspondence between the two sexes. 6. In the distribution in the New England States there is no geographical feature that explains the slight variation, which is easily within the limits of better registration. 7. In the State itself there is a slight increase westward for groups of counties of the same density of population. The densest populated part of the State apart from these shows a little higher rate.

H. C. Major¹ cannot but accept as a fact that the prevailing opinion regards malignant tumors as increasing in frequency. This sad conclusion, he thinks, may be the result of defective certification. L. Pfeiffer, in Germany, holds the same view—statistics are not exact enough. It is suggested by both that as far as possible diagnoses should be verified by the microscope and by autopsy.

Contagiousness of Cancer. Behla² has studied 118 cases (19 hitherto unpublished) of cancer of husband and wife, the interval extending from three months to twenty years. There are, in addition, 43 cases recorded of cancer of the penis and of the uterus in man and wife, and 6 of family cancer in which the members used the same syringe. Eberth has collected 22 cases in which there was direct transmission of cancer from lip to lip, tongue to palate, etc. Behla has 8 instances of death from malignant growths in physicians and surgeons who were inoculated with juices from tumors, and 4 instances of apparent human infection from cancerous cow, dog, and hen. Besides these cases as evidence of the contagiousness of cancer he cites the cancer epidemic among the white mice in the Pathological Institute at Freiburg and a number of undoubtedly successful inoculations of animals with cancer juices (Francote, Rechter, Langenbeck, etc.). Behla injected the fluid from a mammary carcinoma into the jugular vein of a dog, and in three months found a carcinomatous nodule in the liver. He concludes from his review of the subject that even if we concede the simultaneous action of the same cause in many cases, there is, nevertheless, evidence enough to show that the contagiousness of cancer is sufficiently well marked to warrant prophylactic measures.

Successful Transplantation of Sarcoma in White Rats. Leo Loeb,³ starting with a cystic, small-celled sarcoma in the thyroid gland of a white

¹ British Medical Journal, 1901, ii., 144-147.

² Deutsch. med. Wochenschrift, 1901, xxvii., 427-431.

³ Journal of Medical Research, 1901, vi., 28-38.

rat, succeeded in making a large number of successful transplantations, with local metastases, in animals of the same species, both subcutaneous and intraperitoneal. After from ten to fifteen days evidences of growth became apparent, succeeded by rapid development for some days, when central myxoid softening would begin; at the same time peripheral growth continued, the cystic sarcoma eventually equalling the animal in size. In a few cases the injection of cystic fluid into the peritoneal cavity gave rise to large masses. Bacterial infection was frequently seen in the growing tumors, and seemed to play some rôle in causing metastases. The tumors maintained their original and characteristic structure throughout the long series of transplantations. Efforts to transplant the tumor into guinea-pigs, white mice, and hens failed. A number of very interesting problems have suggested themselves to Loeb during the progress of this work, and we may expect important additions to this report in the future. It seems to me that this is a most important contribution to the study of tumor transplantation—important because the transplantations were so uniformly successful. Critical scrutiny of the diagnosis “sarcoma” does not indicate that the present usage or significance of the word have been in any way violated to the slightest extent as applied to the tumors studied by Dr. Loeb.

Disappearing Tumors. Warthin and Spitzley¹ discuss this subject and reach the conclusions that skilful clinical observation alone cannot be relied on in the interpretation of the nature of growths that disappear. Microscopical examination must be resorted to. Many inflammatory conditions may be taken for malignant neoplasms. No true malignant neoplasm ever disappeared except through retrograde changes from direct infection or toxic influences from other parts of the body.

Serum Treatment of Tumors. 1. ANTIBLASTOMYCETIC SERUM IN CARCINOMA. Wlaeff² points out that immune bird serum protects rats against fatal doses of blastomycetes. Immune serum from asses produces a marked leucocytosis both in animals and in man. Normal serum does not do this. With immune serum from geese and asses he claims to have successfully treated a number of cases of localized malignant neoplasms and experimental tumors in animals. Reynier³ treated a case of carcinoma of the tongue and one of the mammary gland with Wlaeff's anticellular serum with some degree of amelioration, but the growths resumed their course as soon as the injections were stopped.

Richet and Hericourt⁴ point out that they obtained in 1895⁵ the same

¹ Medical News, 1901, lxxix. 443-447.

² Comp.-rend. de Soc. biol., 1901, liii., 285-288; also Presse Médicale, March 20, 1901; Vrathe, 1901, July 6 and 13.

³ Gazette hebdomadaire de Médecine et de Chirurgie, 1901, February 21.

⁴ Comp.-rend. de Soc. biol., 1900, lii., 1051, 1052.

⁵ Ibid., 1895, cxxi., 567-569.

results as Wlaeff¹ by immunization with aqueous extract of tumors. Unfortunately, in neither case was complete healing obtained.² The question is discussed further by Wlaeff,³ without anything conclusive being demonstrated. I agree fully with Borrel,⁴ who points out that Wlaeff's treatment is yet without the necessary essential basis, as it has not been definitely shown that the blastomycetes are the cause of tumors. Malvoz failed to find antibody for blastomycetes in persons suffering with carcinoma, whereas rabbits inoculated with blastomycetes contained antibody.

2. ANTISARCOMATOUS SERUM PRODUCED BY TRANSPLANTATION OF FRAGMENTS OR BY INJECTION OF EMULSION OF SARCOMA. Experiments of this kind have been carried out by Louis Dor.⁵ He introduced a large piece of chondrosarcoma of the shoulder into the peritoneal cavity of a rabbit, and a year later repeated the operation on the same animal with a still larger piece of a similar tumor. The second piece was absorbed much more rapidly than the first, indicating, he thought, that the serum of the rabbit had been made cytolytic for sarcoma cells. Dor further injected an emulsion of melanosaarcoma into the subcutaneous tissue of a goat, and three months later an entire melanosaarcoma of the eye was inserted. The serum of this goat was used in the treatment of two cases of melanosaarcoma, in both of which marked amelioration was promptly produced, but actual cure was not brought about. I think that experiments of this kind offer more chance for actually accomplishing something, at least for the present, than Wlaeff's method, which does not rest on a safe basis.

Histogenesis and Histology of Tumors. In normal development cells are arrested at various stages of differentiation (Minot). In the epidermis the basal cells remain more embryonal, while the upper layers are more highly differentiated; in the nervous system, also derived from the ectoderm, certain cells, namely, the neurones, seem to lose almost altogether their power of multiplication. Certain exceptions occur, however, as seen in the occasional though rare development of ganglionic neuromata. In the mesoderm, endothelial cells, red corpuscles, and sexual cells, while early specialized, remain endowed with proliferative capacity, and the connective-tissue cells are arrested in development at various stages of differentiation.

Carcinoma is now regarded as a definite and distinct form of tumor, but when one considers the large number of histological and histogenic

¹ Comp. rend. de Soc. biol., 1900, lii., 1030-1032.

² Concerning bibliography of serotherapy of cancer, see Beretta, *De la sérothérapie dans les néoplasmes*, Thèse, Paris, 1896, and Richet, *La sérothérapie*, 1899.

³ Comp. rend. de Soc. biol., 1901, liii., 106-108.

⁴ Ibid.

⁵ Gazette hebdomadaire de Médecine et de Chirurgie, February 14, 1901.

varieties it would not be surprising, according to Minot, if there were forms with important peculiarities traceable to the layership of the cells from which they spring. From the stand-point of differentiation the basal cells of the ectoderm and entoderm, and of certain mesenchymal derivatives, should possess the greatest power of proliferation, and this is certainly borne out by the observation of pathological processes, because it is precisely in these cells that neoplastic and other forms of proliferation are especially prone to occur.

Alice Hamilton¹ found scirrhus carcinomata to contain a considerable number of elastic fibres, being more abundant than in the surrounding normal tissue. Contrary to expectation, soft, malignant tumors of epithelial origin showed the richest growth of elastic fibres. In adenocarcinoma of the uterus, stomach, and mammary glands the stroma in many instances consisted largely of elastic fibres. Elastic fibres were found also in fibrosarcoma, alveolar sarcoma, and melanosarcoma. The fact that the elastic elements were found in tumor masses, and often in far greater numbers than normally present, indicate that new elastic fibres may form in tumors. Different parts of the same tumor may show different numbers of these fibres, whose arrangement may vary from that in the normal organs. As elastic fibres were most numerous in tumors with stroma rich in connective-tissue cells, Dr. Hamilton is inclined to assign to these cells an important part in the formation of the fibres.

Daniels² reaches these conclusions from his study of the stroma in sarcoma: Sarcomata always possess a stroma of vessels, partly capillary, partly provided with elastic fibres; often connective tissue and elastic fibres are added; the stroma may be preformed or newly formed, and in the former instance it may contain larger vessels.

Interesting Special Forms of Tumors. **GANGLIONEUROMA.** Beneke³ describes in detail two cases of this rare tumor, to which I have made reference in preceding issues of *PROGRESSIVE MEDICINE*. In one case the tumor developed in the connective tissue behind the pelvic peritoneum, grew to the respectable size of 15 x 8 x 10 cm., and constituted a difficult obstruction to labor in a woman, aged twenty-five years.

The tumor consisted of excessive production of ganglion cells, with processes and sheaths and nerves. Beneke then develops the idea that, according to modern views, it would be quite impossible to have a true neuroma—a tumor composed of nerve fibres—without the simultaneous presence and proliferation of ganglion cells. He believes the

¹ *Journal of Experimental Medicine*, 1900, v., 131-138.

² *Virchow's Archiv*, 1901, clxv., 238-248.

³ *Ziegler's Beiträge*, 1901, xxx., 1-48.

growth described by him to be a true tumor, and not an example of physiological overgrowth—giant growth—of a sympathetic ganglion.

Beneke's second case concerns a tumor, 18 x 15 x 12 cm., in the retro-pancreatic region of a girl, aged ten years. The principal mass consisted of greatly multiplied ganglion cells and nerves, as in the first case, but with this feature of added interest, that in certain parts a more marked proliferation of ganglion cells had taken place, so that Beneke regards it as distinctly malignant. By means of transition forms he traces the formation by altered, immature ganglion cells of alveoli filled with oval cells, with deeply stained nuclei and indefinite outlines. Peculiar giant cells are described. Metastases of this structure had developed in adjacent lymph glands, but in these metastases there were no typical ganglion cells and no nerve fibres. It seems to me that Beneke has not excluded altogether the possibility that the malignant areas of the tumor may have developed from proliferation of the cells of the stroma or of Schwann's sheaths. One would naturally hesitate to accept his interpretation without more positive evidence of the ganglionic nature of the morphologically atypical cells which he derives from ganglion cells.

True ganglionic neuromata have been found so far only in the sympathetic nerves as solitary growths (Lorentz, Borst, Busse, Schmidt, Beneke), and as plexiform (Busse) and multiple (Krauss, Soyka).

MENINGEAL CHOLESTEATOMA. Otto Blasius¹ describes a typical cholesteatoma (pearl tumor or epidermoid), as large as a fist, connected with the callosum, surrounded by an epidermal membrane, the cells of which showed all the characteristics of epidermal cells, to wit: fibrillar structure, intercellular spaces, and cornification, with the formation of keratohyalin granules, thus constituting the germinal layer of Boström.² The origin of the tumor is ascribed to inclusion from the epidermis during closure of the medullary tube, and the growth is regarded as an intracranial (or meningeal) epidermoid in the sense of Boström. It was closely connected with the leptomeninx. With nitrate of silver a similar precipitate was obtained as with epidermal cells. In the case studied by Beneke³ silver nitrate gave the reaction seen in the flat cells lining mucous membranes, and as the tumor was situated at the base of the brain it seems likely that it sprang from inclusions of mucous membrane. Intracranial epidermoids may originate, then, either from the epidermal cells of the skin or of mucous membranes.

J. J. Thomas⁴ describes three cases of cholesteatoma of the pia, all of

¹ Virchow's Archiv, 1901, clxv., 504-540.

² Centralbl. f. allg. Path. u. path. Anat., 1897, viii., 1-98.

³ Virchow's Archiv, 1897, cxlix., 95-123.

⁴ Journal of Medical Research, 1901, vi., 221-240.

which at some point or other were surrounded with a layer of more or less cubical cells containing granules of keratohyalin and showing intercellular bridges, and striations from the non-nucleated polyhedral cells of the central parts were easily traced. Thomas accepts the embryological theory as the most satisfactory.

Adenomata of the Adrenals. Oppenheim¹ describes three adenomata of the suprarenals. He divides suprarenal adenomata into fatty and pigmented, the first resulting from proliferation of the cells of the zona fascicularis of the cortex, the second from the zona reticularis. In the second the cells are infiltrated with pigment, which sometimes hides the nucleus. Folli² describes twelve adrenal adenomata. Anna Stecksén³ shows that small adenomatous nodules are very frequent in connection with the adrenals in adults. She also mentions several accessory adrenals, and believes that it is probable that accessory adrenals may form in adults.

Diffuse Papilloma of the Urinary Passages. Busse⁴ describes two interesting instances of diffuse papillomatous growths in the urinary tracts. In one case there was a history of periodical hæmaturia for twenty years. The mucous membrane of the pelvis of the right kidney, which was converted into a hydronephrotic sac, of the right ureter and of the bladder about the ureteral orifice, was covered with masses of papillary proliferations of a wholly benign type. In the second case a history of hæmaturia and pain in the left kidney extended over seven years. Here there was a diffuse papillomatous growth of the pelvis, the ureter, and the bladder, with hydronephrosis. In the bladder the growth was distinctly carcinomatous in places. There are, according to Busse, only five similar cases recorded. The cause of the hydronephrosis is not clear. The cases appear to illustrate the involvement of whole organs in tumor formation, as seen in the gastro-intestinal tract, in fibromata of the nerves, etc. At the earlier stages in their formation it would probably be very difficult to distinguish them from inflammatory hyperplasias, in which they may have their origin.

Does Primary Sarcoma of Bone Occur? Fittig⁵ describes a case of flat-celled carcinoma in the ulna developing in direct sequence to a definite trauma. The case is analogous to one described by Carola Maier and regarded as primary in the bone. At the time of the injury and for some time afterward the patient seemed perfectly healthy. A thorough examination, however, revealed a small, ulcerating carcinoma

¹ Bull. et. Mém. de la Soc. d'Anat. de Paris, 1900, lxxv., 997-1011.

² Archivio per la Scienze Médica, 1901, xxv., 63-69.

³ Arbeiten aus pathologisch-anatomischen Institut zu Tübingen, 1901, iii., 253-260.

⁴ Virchow's Archiv, 1901, clxiv., 119-132.

⁵ Beiträge z. klin. Chir., 1900, xxvi., 553-556.

of the larynx which had not given rise to any symptoms. Osseous metastases in latent carcinoma may simulate very much primary tumor of bone, a fact that should be borne in mind in connection with tumors of bones in general. I have had occasion to observe the amputation of whole limbs under the diagnosis of primary sarcoma of bone, while it really concerned secondary carcinomatous growths. In one case the primary, but latent, tumor was situated in the prostate. Indeed, Fittig recommends a preliminary excision, for diagnostic purposes, of all intra-osseous tumors. While the possible occurrence of primary carcinoma in bones (other than the maxillæ) cannot be denied on theoretical grounds, it may be extremely difficult to exclude the secondary character of apparently primary osseous carcinoma.

Primary Carcinoma of the Lungs. Dinkler¹ describes an instance in a student, aged twenty-one years. The clinical symptoms were principally those of bronchitis and bronchopneumonia. Post-mortem, both lungs were involved, and the picture resembled greatly that of caseous pneumonia. There was a small metastasis in the stomach, which Lubarsch was inclined to regard as the primary tumor. Ponfick² emphasizes the comparative frequency of primary carcinoma of lung as seen in Breslau. In one, severe, sudden hemorrhage ended life, the carcinomatous process, starting in the left bronchus, destroying the continuity of a branch of the pulmonary artery; and Langerhans announced that he had examined, post-mortem, during the last six years at least twenty primary carcinomata of the lungs, the majority being bronchial. Pulmonary carcinomata may develop in three places—most frequently from the epithelium of the bronchi, more rarely from the mucous glands of the large bronchi, and lastly from the alveolar epithelium itself.

Squamous Carcinoma of the Gall-bladder and of the Renal Pelvis and Ureters. Deetz³ describes four cases of squamous carcinoma of the gall-bladder, in all of which there were metastases of a squamous character, with cornification, and in three prickles cells were demonstrated; hence the diagnosis of squamous carcinoma must be regarded as fully established. In the literature Deetz found five additional cases of this kind. The development of squamous carcinoma upon a deeply seated mucous membrane like that of the gall-bladder, with normal cylindrical epithelium, brings up an interesting question in epithelial transformation. Three possibilities are suggested—embryonal displacement, replacement of cylindrical by flat cells, and metaplasia. The two first are hardly applicable to the gall-bladder, because there is normally no flat cells in its immediate vicinity, and because

¹ Verh. Deutsch. pathol. Gesellschaft, 1900, iii., 59-61.

² Ibid.

³ Virchow's Archiv, 1901, cliv., 381-405.

it did not in any of these cases communicate with the skin ; hence metaplasia offers the only explanation. Physiological metaplasia occurs in the stomach of a number of animals with but poorly developed teeth. In young cats the trachea is lined with cylindrical cells, but later in life flat cells appear at certain places. The uterus, the urinary tract, the eye, the ear, the respiratory tract offer interesting examples of metaplasia under pathological conditions. Whether metaplasia occurs in the gall-bladder under pathological conditions does not seem to be definitely known. Klebs and others describe an epidermoid character of the mucous membrane in chronic cystitis with hydrops. Deetz examined a large number (300) of gall-bladders without finding a single instance of metaplasia ; hence the causes which led to metaplasia in the four cases of carcinoma described by him are entirely hidden unless, perchance, the transformation was dependent on the calculi present in every case. The exact chemical and physical conditions that lead to metaplastic changes in epithelial surfaces have not yet been determined, but it seems not unlikely that mechanical pressure plays some part. Finally, it is of interest to note that in two of Deetz's cases there were apparently independent primary carcinomata in the same body—in one case a cylindrical-celled carcinoma of the rectum ; in the second, more complex, case there was a cylindrical carcinoma of the gall-duct. The possibility of metastasis is discussed by Deetz, and it seems to me that the difficulties in the way of excluding this possibility are so great that the exact nature of the cases will always be doubtful.

Kichensky¹ describes an equally unusual case of squamous carcinoma of the calyces and pelvis of the right side in a woman, aged thirty-two years. There were numerous metastases, all the growths showing epithelium characteristic of the urinary tract, and in the renal pelvis a marked tendency to cornification and petrification. The case is also remarkable because of a pronounced cornification of the mucous membrane of the right ureter ; in some places papillary down-growths had occurred. The literature bearing on the case is reviewed. Epidermization of the mucous surfaces of the urinary passages has been described several times, and generally explained as a form of metaplasia.

Metastasis of Normal Thyroid and of Thyroid Tumors. Oderfeld and Steinhaus² removed from the left frontal eminence a tumor, "the size of an egg," of three months gradual growth. The microscopical examination did not confirm the clinical diagnosis of sarcoma of the frontal bone, as the structure of the growth was that of the normal thyroid gland. The thyroid gland of the patient appeared wholly normal. Riedel has described a similar case, the growth being located

¹ Ziegler's Beiträge, 1901, xxx., 348-370, and Arch. russes de path., 1901, vi.

² Centralbl. f. Path., 1901, xii., 209-212.

in the mandible, and in this case a return of the growth took place ten years after removal. Becker designates a thyroid growth in the supraclavicular region as metastasis of normal thyroid tissue, but accessory thyroid glands occur in the supraclavicular fossa. The cases described by Oderfeld and Steinhaus and others are regarded as metastases of normal thyroid tissue, due to the entrance into the bloodvessels of a few cells which by their vitality increased to form large masses of tissue. Examples have also been described of metastasis of carcinoma of thyroid and normal thyroid tissue at the same time, and so-called benign goitres may give rise to metastases free from carcinomatous changes.

Reference has already been made to Wells' important case of mixed primary sarcoma and carcinoma of the thyroid of a dog.

Amyloid Tumor of the Thyroid. Burk¹ has described an amyloid tumor in the thyroid, with metastases in the lymphatic glands, the lungs, the pleuræ, and the left cerebellar hemisphere. The primary tumor was as large as a fist, of cartilaginous consistence; it was made up of homogeneous, somewhat eccentric amyloid scales and masses, surrounded by areas of small round cells. The author believes this case to be unique.

VASCULAR INVOLVEMENT IN SARCOMA OF THE THYROID. Hedinger,² in a number of sarcomas of the thyroid, finds as a common occurrence a marked development of sarcoma in the intima of the veins and more rarely in the arteries, especially at the periphery of the tumors. The endothelial lining was generally intact, even though the lumen of the vessels was greatly altered and distorted, and the question whether the tumor growth in the intima is the result of invasion of sarcoma cells from without or of proliferation of the so-called intima cells is left open. It seems more likely, however, to be the result of invasion. The persistence of the endothelium permits the inference that this lining protects against invasion of the general blood-current.

SARCOMA OF THE THYROID. Lartigau³ describes an angiosarcoma of the thyroid arising in a goitre, and considers the literature. I append his conclusions: 1. Primary sarcoma of the thyroid gland is rare, but probably of more common occurrence than statistics show, yet it is less frequent than primary carcinoma of the thyroid gland. 2. It is commonly associated with goitre, and these cases developing in persons between forty and sixty years of age show a higher percentage of previous goitre than younger individuals, while goitre associated with

¹ Centralbl. f. allg. Path. u. path. Anat., 1901, xii., 673. The complete publication is in the form of an inaugural thesis.

² Virchow's Archiv, 1901, clxiv., 199-238.

³ Am. Journ. of Med. Sci., 1901, cxxii., 156-166.

sarcoma of the thyroid is more common in women than in men. 3. Sarcoma of the thyroid occurs oftener in late than in early life, and the greatest age-frequency is between forty and sixty years. 4. Sex is probably an unimportant element in its development. 5. The primary tumor most frequently originates in the right lobe of the thyroid body; this distribution seems to be more frequent in men than in women. 6. The clinical course of the disease is usually relatively acute. 7. Involvement by pressure or new-growth of the trachea or larynx is common. 8. Metastasis occurs through the blood or lymph channels, or both. 9. Round and spindle or mixed-celled sarcomata are most common.

Malignant Leiomyoma. Devie¹ describes a leiomyoma in the thoracic wall which recurred five times after as many operations in the same number of years; a recurrent leiomyoma of the thigh, and a subcutaneous tumor in the right iliac fossa, which grew rapidly and soon caused death, the autopsy showing multiple leiomyomata in the viscera. The secondary tumors in the kidneys weighed eight kilogrammes. He mentions the cases similar to the last in European literature, eight in all, six in the uterus or pelvis, two in the stomach. He found also one case of subcutaneous tumor similar to his three; in this case death resulted from generalization. Histologically these tumors consisted of smooth muscle cells quite regularly arranged, with but little connective-tissue stroma.

Multiple Leiomyoma of the Kidney. Lartigau and Larkin² describe two instances of multiple leiomyoma of the kidney originating in part from the capsule of the organ, in part from the bloodvessels. In neither case were symptoms produced during life.

Multiple Endothelioma of the Bone-marrow. Carl Sternberg³ reports a single case of a peculiar hitherto undescribed tumor, confined to the bone-marrow, in a woman, aged sixty-two years. The marrow of the femur, humerus, and other bones contained small, grayish-white, globular, sharply circumscribed nodules, which were easily peeled out. Larger irregular foci occurred in the spongiosa. The spinal column was infiltrated with grayish-white foci with indistinct outlines. These growths were composed of large, round, clear, vesicular cells, with a semilunar or sickle-shaped, well-stained, peripherally placed nucleus. The contents of the vesiculated cells often consisted of fine detritus. Between the cells was a fine network of capillaries. Extensive necrosis was present. In some places, especially in the epiphyses, were found within vascular spaces larger cellular cords of cuboidal, epithelioid

¹ Rev. de Chir., 1901.

² Journal of Medical Research, 1901, vi., 25-27.

³ Centralbl. f. allg. Path. u. path. Anat., 1901, xii., 625-633.

cells, with round nuclei and a small cell body interspersed with vesicular ("siegelringähnlichen") cells like those just outlined. The bone tissue was unchanged. Thionin stained the swollen cells red. The structure of these multiple tumors corresponds with that of certain tumors of the ovary described by Krukenberg¹ from Marchand's laboratory under the name of fibrosarcoma ovarii mucocellulare (carcinomatoides). Sternberg's case is remarkable on account of the diffuse involvement of the skeleton. In accordance with the prevalent custom he would prefer the name endothelioma, as there seems to be no doubt that the cells are derived from the lining of the blood and lymph spaces. The peculiar character of the cells is regarded as the result of a mucoid change in their interior. Clinically, the case presented the picture of pernicious anæmia.

In connection with this I would mention that Schönerberger² has described a genuine osteomalacia of the whole skeleton, with numerous fractures and tumors of the structure of giant-cell sarcoma. He refers to more or less similar cases in the literature, of which the one described by Recklinghausen presents quite a complete likeness to his own. The disease is regarded as a distinct process.

Endothelioma of the Lung. I. Alder³ describes a primary endothelioma of the lung and pleura from a young man, aged twenty-six years. The growth could be traced to the cells lining the lymph vessels, some of which presented an adenomatoid appearance. From the gross appearances Alder believes that the tumor was primary in the lung, thus adding one more to the small list of endothelioma of the lung.

Melanotic Tumors. Hartzell⁴ describes a pigmented epithelioma of the cheek, some of the cells of which showed faint traces of prickles. Many clumps of yellowish-brown pigment are described as lying between and in the cells, which were arranged in alveoli; but as it is not shown whether this pigment contained iron or not, it seems to me unwarranted to point to this growth as supporting Unna's theory that malignant growths arising from pigmented moles are carcinomas, and not, as formerly believed and still held by many, sarcomatous in their nature.

Browicz⁵ obtained intracellular crystals by exposing for some time sections of melanosarcoma containing hyaline balls to the action of 10 per cent. hydrochloric acid. He concludes that hyalin—a form of albumin—forms crystallizable combinations with hydrochloric acid. Hæmatoidin crystals were obtained in a similar manner from golden-

¹ Arch. f. Gynäkol., 1896, l., 287-321.

² Virchow's Archiv, 1901, clxv., 189-226.

³ Journal of Medical Research, 1901, vi., 175-186.

⁴ Proceedings of Path. Soc. of Philadelphia, 1901, iv., 159-160.

⁵ In a number of Polish articles abstracted in Centralbl. f. Path., 1901, xiii., 164-166.

yellow, iron containing intracellular masses of hyalin, showing that the iron is loosely bound, forming with hydrochloric acid soluble iron salts. This observation is regarded as supporting the view that melanin may be derived from hæmoglobin. There are two distinct views in regard to the origin of the pigment of melanotic tumors, one deriving it from hæmoglobin, the other from the metabolic activity of the cells. The latter view is based largely on the fact that melanin contains sulphur, but not iron. Browicz points out that there are iron-free derivatives of hæmoglobin (bilirubin, hæmatoidin). In the pigmented cells of a melanosarcoma he found erythrocytes and brown pigmentary granules, in other cells vacuoles with needle-shaped, brown crystals, free from iron, but according to the investigations of Browicz, crystallized derivatives of hæmoglobin. Much of the pigment in melanosarcomata is bound to a hyaline substance, which Schmiedeberg shows contains sulphur in sufficient quantity to account for the sulphur generally extracted from melanin.

Embryomata of the Ovary and Testicle. Katsurada¹ describes four ovarian dermoids or embryomata (Wilms). In one he found heart muscle (not previously encountered in these growths). In one specimen the thyroid gland was the seat of marked colloid changes, and in the nervous substance he found numerous corpora amylacea. He emphasizes that embryomata, as a rule, contain derivatives of all three germinal layers, although the ectodermal often predominates over the entodermal, and that the arrangement of the tissues and rudiments of organs generally corresponds more or less with that of the human foetus. The theory, recently urged especially by Bonnet,² that the embryomata spring from dislocated blastomeres, or blastomeres whose development is delayed, is regarded as the most satisfactory; but the inability to satisfactorily account by means of this theory for the predominance of embryomata in the ovary and testicle is freely acknowledged.

Hendrickson³ describes a complex tumor of the testicle—a teratoma with connective tissue and cartilage, epithelial-lined cysts and adrenal-like structures, with an extensive perithelial proliferation giving rise to gland-like and papillomatous masses.

¹ Ziegler's Beiträge, 1901, xxx., 179-214.

² Monatsch. f. Gebh., 1901, xiii., 149-176.

³ Univ. of Penna. Med. Bull., 1901, xiv., 202-204.

LARYNGOLOGY AND RHINOLOGY.

By ST. CLAIR THOMSON, M.D.

AT an annual gathering of the Laryngological Society of London I once heard a leader of the profession quote with approval the remark of a great statesman, "Happy is the country which has no history." He went on to say that the specialty of rhino-laryngology was like one of these fortunate nations in that it need only go back to the year 1855, when Garcia invented the laryngoscope, or 1858, when Türk and Czermak first practically applied it in the study and treatment of diseases of the throat. The speaker was careful to add that this blissful state might be disturbed if a laryngoscope should some day be dug up in the excavations always going on at Pompeii, or if a reference to it were deciphered on an Egyptian obelisk!

The possibility foreseen by Sir George Johnson, the speaker referred to, has to a large extent been realized; but the happiness of laryngologists has not been diminished, but rather increased by it! The early laryngoscope has not yet been unearthed, but our attention has been directed by Dr. Jonathan Wright to an inscription found in the tomb of an Egyptian king of the fifth dynasty—a matter of 3500 years before the birth of Christ—wherein the monarch records his gratitude to his doctor because he had "made his nostrils well." Dr. Jonathan Wright's investigations into the "Nose and Throat in Medical History,"¹ starting with this memorial of the first rhinologist on record, are carried on through Egyptian, Chaldean, Hindoo, Greek, and Roman history to the development of the Eastern Empire, and then to the period which links the Greek civilization with the present—viz., the Arabian. We hardly know what impresses us the most in reading these charming studies—the erudition and patient research which they indicate, the grace with which they are written, or the genial sympathy and humanity with which they are embellished. They show that, although we had to wait until A.D. 1855 for the invention of the laryngoscope, the study of throat and nose affections goes back to long before Hippocrates, and that our specialty flourished in the crowded cities of the Nile before 3000 B.C. No studious laryngologist should miss the treat provided for him by Dr. Jonathan Wright.

¹ Laryngoscope, July, 1901, and following numbers.

Not only has the antiquity of laryngology been thus established during the past year, but a statement of its present broad position and future importance has been submitted by John N. Mackenzie¹ to the annual gathering of the American Medical Association. He considers that though the study of laryngology is of vital importance both to the profession and the public, it is grossly neglected in most medical schools both of Europe and America. He does not in this refer to the fairly complete post-graduate teaching, but to the schools, where the students seldom take laryngology seriously, as it is only occasionally required for degree examinations. Of all the pure specialties—that is to say, those branches requiring special technique and special instruments and methods of precision—it is the most generally useful to the diagnostician and general practitioner. The term laryngology in its broadest sense comprises the upper respiratory air-passages, the accessory cavities, and the middle ear. The laryngoscope should follow the evolution of the stethoscope and become the common property of the general practitioner of medicine. It will be an absolute necessity in that specialty which, next to surgery, is the highest of them all—internal medicine. The laryngologist as a specialist has, in some quarters at least, proliferated to an alarming extent, and this is leading to such congestion that some of them are driven into the ranks of general medicine, while others are compelled to take up some other special line of practice in addition. A greater general knowledge of laryngology will have a salutary effect in relegating to the rear that unfortunately numerically large element in our midst whose only claim to special knowledge resides in the possession of the necessary armamentarium.

After sketching the development of the specialty, a description is given of the method of teaching adopted in the Johns Hopkins Medical School. The article concludes with a plea against isolating the special study of laryngology and a picture of the ideals which should animate its votaries.

All such addresses serve an admirable purpose, and among those who devote themselves to special practice there are always some who require a little chastening. But having had the opportunity of viewing laryngology for some years from the point of view of a general physician, I must say that I think equally ardent appeals might be addressed to those in high places—the physicians and surgeons who compose examining boards, the senior staffs of hospitals, and the influential laymen who give their help on committees of management. If the efforts of laryngologists to enhance the reputation and value of their department were more generously met, their colleagues in other walks would have

¹ Journal of the American Medical Association, July 20, 1901.

less cause to cry out against the "narrow specialist;" and if teaching schools would but provide adequate accommodation for the examination of patients and the instructions of students there would be no cause for outcry against special hospitals, and the occupation of the post-graduate teacher would be gone.

PHYSIOLOGY.

Genital Areas in the Nose. Five years ago the publication by Fliess of his discovery of so-called "genital areas" in the nose was met with a hail of ridicule and contempt; yet on January 11, 1901, very similar views were advanced by Arthur Schiff¹ before the Imperial Royal Medical Society of Vienna, and he received the support of the majority of those present. Fliess had found that the "genital spots" on the inferior turbinal and the tuberculum septi became hyperæmic during menstruation. By applying cocaine to the turbinal he found that the hypogastric pain ceased, and when the tuberculum septi was similarly anæsthetized the lumbar pain ceased. The application of the galvanocautery to these points afforded complete relief from the sufferings of dysmenorrhœa, not only in nervous dysmenorrhœa, but also in many of those cases associated with disease of the sexual organs. In pure mechanical dysmenorrhœa dependent on stenosis of the cervix, antelexion, etc., it was not successful. Schiff tested these views in 47 cases, and in 34 of them he obtained temporary relief from dysmenorrhœic pain by the application of a few drops of a 20 per cent. solution of cocaine. Of the 13 negative cases there were 9 which showed pathological changes. Schiff made over 200 observations, carefully excluding the possibility of suggestion, and repeating the observation on more than one occasion. In 12 out of 17 cases of dysmenorrhœa the application of the cautery to the "genital spots" secured permanent freedom from pain.

The connection between the nose and the sexual organs is well established. It is too well-known an association in the lower animals to need referring to, and the study of the subject in the biped we call *homo sapiens* has elicited some of the most interesting papers on laryngology. Still, whether the result of an instinctive scientific skepticism, or a restraining desire not to view disease entirely through the nasal speculum, the first reflection prompted by the above would be that the results obtained were due to suggestion, and the second would be that they might be induced by the general nerve stimulation from the absorption of cocaine. Some time spent in the study of the methods of the hypnotic

¹ Wiener klin. Wochenschrift, January 17, 1901, No. 3.

school at Nancy has impressed me with the great part played in therapeutics by suggestion, often through the most indirect channels. But Schiff foresaw this criticism and was prepared to refute it. When he used water ostensibly as cocaine he failed in securing relief of pain. Any sensitive patient who has had his nose sprayed with cocaine knows the feeling of exhilaration and the sense of fearlessness it induces. But here, again, Schiff is prepared with a refutation. He had sometimes painted the whole pharynx and the greater part of the nose—carefully omitting the “genital spots”—with a 20 per cent. solution of cocaine, sufficient to produce cocaine intoxication, and yet the pain of dysmenorrhœa persisted; yet when even a 2 per cent. solution was painted on the exact points relief was promptly secured.

Our possible objections having thus been guarded against, we can only await further confirmation. This should not be long delayed. If the pains of labor can be assuaged by this simple and harmless procedure, the various lying-in hospitals afford a large field of observation for securing anæsthesia by cocaine in a way far preferable to that of introducing it by spinal puncture.

Air Currents in the Nose. The directions followed by the air currents in the nose have given rise to numerous studies. Some observers have come to the conclusion that the air chiefly traversed the lower meatus, while others have thought that it passed through the middle passage. The researches of Kayser, Paulsen, G. Franke, and MacDonald may be referred to. The subject has lately been investigated *de novo* by C. A. Parker,¹ as he had considerable difficulty in accepting the idea that inspired air travels through the lower part of the nasal cavities, on the following grounds:

1. Patients with an absolutely free inferior meatus and post-nasal space will often complain of stuffiness and inability to breathe through the nose.

2. Hyperplastic or œdematous enlargement of the middle turbinates, especially of their anterior ends, or mucopurulent catarrh affecting the middle meatus, may cause difficulty of nasal respiration, although the lower passages may be unusually patent.

3. Polypi will cause marked nasal obstruction, even in slight cases where the inferior meatus is quite free.

4. A very slight enlargement of the adenoid tissue in the post-nasal space will cause considerable difficulty to nasal inspiration. On examining such a case with a post-rhinoscopic mirror the whole of the inferior meatus and lower turbinates is easily seen, and often the greater part of the middle passages. The adenoids may only hide the upper fourth of

¹ Journal of Laryngology, July, 1901.

the septum, and yet obstruction will be complained of. Even in cases of great enlargement of the adenoid tissue it is quite rare to find the lower passages hidden from view.

These facts suggest that nasal inspiration takes place—at all events to a very great extent—through the middle meatuses.

To verify this he carried out a series of observations on living subjects, making them inhale air into which the light powder of lycopodium had been blown, and then observing where it became deposited inside the nose. To test the direction taken by expiratory currents the subjects were made to smoke cigarettes and gently exhale the smoke through the nose, while he watched its course through a nasal speculum.

He found that the current of in-going air first impinged on the septum, about one-third of an inch from the floor of the nose, then spread along the septum, covered the anterior end of the middle turbinal, and shot upward into the upper part of the nose. The important negative "finding," as the Germans would say, was that the lycopodium powder entirely missed the inferior meatus and lower turbinal. The lowest meatus seems to serve principally as the channel of expired air. C. A. Parker's conclusions are thus summarized :

These observations show :

1. That during quiet inspiration in a normal nose the air traverses the middle, superior, and probably the fourth meatus.

2. That inspiration is impeded by :

- a. Spurs and deviations of the septum and enlargements of the inferior turbinated body, if they project forward and upward. (For practical purposes I think a rule may be laid down that if such abnormalities cross and break an imaginary line drawn from the anterior extremity of the inferior meatus—*i. e.*, just internal to the vestibule—to the anterior end of the middle turbinate, they will cause obstruction.)

- b. Enlargements of the middle turbinated body, polypi, etc.

- c. Hypertrophies and growths springing from the vault of the nasopharynx.

3. That in expiration the air traverses chiefly the inferior meatus.

4. That expiration will be more especially affected by :

- a. Hypertrophies of the posterior end of the inferior turbinate.

- b. Hypertrophies, etc., causing stenosis of the inferior meatus.

The practical applications of these observations will be referred to later on in a debate on nasal obstruction which took place at the annual gathering of the British Medical Association.

GENERAL THERAPEUTICS.

Suprarenal Extract and Adrenalin. We do not appear to have in the English language any word which is precisely the equivalent of the French slang expression "*de s'emballer*." It is, therefore, difficult to translate it, but it means something more than "running away with an idea" or "getting carried off one's legs." Perhaps it would be best to give some examples. The profession might have been said to "*emballer*" itself over the reflex points in the nose first enunciated by Hack, the suspension treatment for tabes suggested by Charcot, or Koch's first introduction of tuberculin. I hope we laryngologists are not going to get "*emballé*" over what really promises to be the most valuable addition to our pharmacopœia since the discovery of the local action of cocaine. I refer to the separation of the active principle of the suprarenal gland, under the name of adrenalin, and its application in producing a bloodless field of operation. It is safe to say that without the local anæsthesia produced by cocaine the great developments of rhinology had not been possible. Now there is every prospect that in many cases we shall be able to have not only a painless, but a bloodless field for operation, while the risks of cocaine intoxication will be lessened, and many other subsidiary advantages will be obtained from this organic extract. The past year was prolific in literature on the subject, and the drug must pass through the usual stages of exaggeration, and then depreciation, before it assumes its proper niche in our armamentarium. So much of the literature has been circulated by the chemist that I need only refer to some illustrative opinions.

Adrenalin was first separated by Dr. Takamine, and its discoverer attended the May meeting of the American Laryngological Society and gave some interesting observations on its chemical properties.¹ It occurs in minute brownish-white crystals, of varying forms, soluble in water which has been slightly acidulated with hydrochloric acid. This adrenalin chloride is placed on the market in one-ounce glass-stoppered bottles, in a clear solution of 1 in 1000 normal salt solution. If protected from the light and kept stoppered I have found that even after it has once been opened it will keep for months without deterioration. This permanence is obtained by the addition of 0.5 per cent. of chloretone, which is not only an efficient germicide, but possesses a local anæsthetic action comparable to that of a 1 per cent. solution of cocaine. The solution can be sterilized without in any way losing its properties. Adrenalin can be had in the form of tablets, usually a tartrate or boro-

¹ American Medicine, June 1, 1901.

tartrate. Further particulars in regard to the pharmacology of adrenalin must be left to the section of therapeutics.

HÆMOSTATIC AND ANÆSTHETIC ACTION OF ADRENALIN. Turning now to the physiological action of the drug, we are chiefly concerned, in this department of practice, in considering two of its properties, viz., the hæmostatic and the anæsthetic. In many cases its activity is remarkable. A fraction of a drop of the aqueous solution of adrenalin or its salt in the strength of 1 in 50,000 is said to blanch the normal conjunctiva within a minute. My own experience with it has been chiefly in preventing hemorrhage in operations on the nose. I have not yet tried how dilute a solution one may get satisfactory results with, but have simply employed the standard 1 in 1000 strength. In a majority of cases the results have been most satisfactory; the red mucous membrane has sometimes been blanched almost to whiteness, and I have removed the anterior end of the inferior turbinal without the loss of ten drops of blood. The convenience of this to the rhinologist need hardly be insisted on. Not only has he a clear field during an operation, but he can complete his work satisfactorily without the usual haste to insert a plug before hemorrhage starts. The drug is applied on cotton, closely applied to the surface it is required to influence. Disappointment has occurred in many cases where sufficient time has not been allowed for the physiological effect to be produced. We are so accustomed to the quick effect of cocaine that we are inclined to simply paint the surface with adrenalin and expect to find its effect in three or four minutes. I find that a longer time is required, and that at least ten minutes, and preferably fifteen, should be allowed to elapse before a decided effect is produced. With regard to its anæsthetic effect I am not yet able to offer an opinion, but it is evident that after the use of adrenalin we are not only able to secure local anæsthesia with a smaller quantity of cocaine than we formerly employed, but we are also much more likely to escape symptoms of intoxication; the cocaine acts locally on the ischæmic surface without being absorbed. I have seen no poisonous effects from absorption of the drug, though local irritation and discomfort have been complained of in the nose when it has been used simply as an astringent—not for operative purposes. Like cocaine, this retractile effect is followed by subsequent turgescence. Casselberry¹ found it acted admirably in certain cases of acute rhinitis, and seemed to aggravate others because of this reaction. It gives a temporary relief in laryngitis and tracheitis, when it might be used in a spray with liquid vaseline. Fletcher Ingals² found a spray of it useful in epistaxis, and states his belief that it will give great

¹ Journal of the American Medical Association, March 30, 1901, p. 914.

² Ibid., April 27, 1901, p. 1155.

relief in acute and subacute laryngitis, and he thinks it probable that when applied to "acutely congested" cords, in vocalists, it will reduce the swelling and congestion so thoroughly that the voice may be used for two or three hours with comparative ease and possibly with normal efficiency. Now it seems to me that until we know (a) why vocal cords become "acutely congested," (b) what takes place not only on the surface of the cords, but in and around them when they are so inflamed, and (c) what are all the physiological effects of adrenalin, it is a very dangerous doctrine to suggest that simply because we are able to blanch the surface of inflamed cords and reduce superficial congestion we should permit of our vocalist patients using cords in which, doubtless, inflammatory changes are still going on in their depth, no matter what temporary apparent alleviation may be secured on the surface. No drug yet invented has upset the principle of treatment that for "acutely congested" vocal cords the first and most important prescription is vocal rest.

The hæmostatic action of suprarenal extract is well illustrated in a case reported by Mackenzie¹ of persistent epistaxis in a hæmophilic boy, aged thirteen years. There was in the case a clear history of the hemorrhagic diathesis, both personal and hereditary, and on two occasions the extract acted instantaneously after other remedies had failed. The clear adrenalin solution is both more effective, more practical, and much handier than the liquid made by crushing tabloids of the suprarenal gland in water and waiting for it to settle before using the supernatant fluid.

The analgesic effect is shown in two cases by Peters.² In the case of a malignant stricture of the œsophagus the sipping of a 10 per cent. solution of suprarenal extract gave great relief, and a similar result was observed in a case of tuberculous laryngitis.

In the discussion on the drug before the American Laryngological Society,³ Stucky reported that it produced some anæsthesia, and that the hemorrhage occurring afterward was not more than might be expected under ordinary circumstances when the drug was not used. Lederman found that it lessened the quantity of cocaine required and the tendency to toxæmia, and MacCuen Smith thought that this preventive action was of peculiar value. On the other hand, O. J. Stein had been disappointed in the hæmostatic action, and Holbrook Curtis mentioned cases of individual idiosyncrasy in which it acted very badly. One man to whom it had been given sneezed continually for two and a half hours afterward. He had given it to several hay-fever patients, and after they had used it for several days they had the most

¹ British Medical Journal, April 27, 1901.

² Lancet, March 2, 1901.

³ American Medicine, June 1, 1901.

intolerable pain, and had to cease using the drug. He had used it on himself, and the result had been to set up violent coryza. B. C. Myles had lost some faith in suprarenal extract, owing to the irritation it produced, and L. L. Mial had experience of two cases in which it had produced violent sneezing lasting from ten to twelve hours. M. R. Ward, while not questioning the power of adrenalin or the suprarenal extract to control hemorrhage, had in plastic work on the septum seen difficulty produced in the way of sloughing. In one of my patients with hay fever the patient acknowledged that the remedy was far worse than the disease. In that instance it must be noted that I gave the more irritating suprarenal extract, and Dr. Takamine has expressed himself at a loss to understand why adrenalin should have had the irritating effects ascribed to it.

The hæmostatic action of the suprarenal gland in cases of apparently hæmophilic character has been shown by W. Thelwall Thomas,¹ and its use in persistent epistaxis has been recommended by Lewis S. Somers.² He points out its great superiority over iron salts, as the gland extract arrests hemorrhage not by producing over the bleeding spot a clot which has come away some time and so risks the recurrence of bleeding, but by leaving the bleeding area completely exsanguinated and the vessels firmly contracted—no clot remaining to become detached later and cause secondary hemorrhage. The drug can be sprayed into the nose or applied on cotton. Where the bleeding is profuse the nasal chamber may require to be firmly plugged for a few hours with tampons soaked in the solution. The solid adrenalin itself could be blown into the nose. For bleeding in other parts of the air-tract—after tonsillotomy, laryngeal hemorrhage, etc.—the solid adrenalin (sold in 1-grain vials) might be insufflated, or the saccharated gland (supplied in powder and capsules, each representing one-twelfth of an entire fresh gland), or the tablets referred to may be crushed and used as required. With regard to its action in epistaxis, Lewis S. Somers points out that in conditions characterized by congestion and erosion of the mucous lining the results obtained clearly indicate that it possesses a further action than that of vascular constriction, and this is shown in the rapid changes taking place in the physical condition of the parts. The erosions heal and a general nutritive tone is given to the tissues that no other local remedy seems to possess.

This is not the section in which to enlarge upon the more remote, if more important, physiological action of the principle of suprarenal gland, but hemorrhage from the upper air-tract is so often associated with vascular depression that it is both of interest and value to

¹ British Medical Journal, November 23, 1901.

² Philadelphia Medical Journal, March 2, 1901.

remember the restorative and stimulative effect it produces on the circulatory system. We have the great authority of Prof. Schäfer,¹ of Edinburgh, for the opinion that "another class of cases in which it may prove of the greatest clinical value are those of sudden cardiac failure, whether as the result of shock or hemorrhage or of an overdose of anæsthetics." He suggests that a sterilized solution might be injected with a hypodermic syringe very slowly into a superficial vein, or even, in extreme and hopeless cases, into the heart itself through the thoracic wall. He has seen remarkable results from the application of this method to animals in which the circulation had apparently entirely ceased, and in which the heart had been completely resuscitated by the action of the drug. He has no hesitation in recommending that it should be tried in this class of cases in the human subject. This restorative action from collapse has been noted by clinical observers. J. A. Stucky² gave half a drachm of the 1 in 5000 solution to a child who did not rally from anæsthesia, and in five minutes the color came back to the child's face. In our department early symptoms of collapse might be met by dropping a little of the adrenalin chloride into the nose.

Albert E. Bulson, Jr.,³ supports my own suggestion that strengths of less than 1 in 1000 are too mild even for eye work. He thinks that future experience may even indicate 1 in 500 solution as the standard for operative work.

SUPRARENAL EXTRACT IN HAY FEVER. With regard to the use of the drug in hay fever, one of the first records was the case of S. Solis Cohen⁴ himself, who found that the symptoms from which he suffered were controlled by using a 5-grain tablet of suprarenal extract by the mouth every two, three, or four hours, according to the results obtained. A further study by Lewis S. Somers⁵ on twenty-one patients brought him to the conclusion that, while no sweeping conclusions could be made, the internal use of the drug is inert in its effects upon hay fever, and even unfavorably influenced concomitant asthma. Locally, however, he believes it to be the most satisfactory single remedy we at present possess for restoring the nasal respiration, diminishing secretion and nasal attacks of sneezing, and practically making the patient comfortable so long as the applications are continued. On the other hand, Beaman Douglass⁶ recommends the internal administration of 5 grains of the dried saccharated suprarenal gland at first as often as every two hours, until some giddiness or palpitation is observed, or until the local examination of the nasal

¹ British Medical Journal, April 27, 1901.

² Medical Age, June 10, 1901.

⁴ Therapeutic Gazette, February, 1900.

⁵ Philadelphia Medical Journal, December 8, 1900.

⁶ Medical News, 1901.

³ Loc. cit.

membrane shows that the remedy is controlling the vasomotor paresis. He also at the same time prescribes it locally.

UNTOWARD EFFECT OF SUPRARENAL EXTRACT. In view of the wide and increasing use of the adrenal gland we should be on our guard against any such possible development as that recently recorded by S. Solis Cohen.¹ It occurred in the case of a patient with chronic catarrhal laryngitis and spasmodic asthma. After prolonged use of the voice, and occasionally after exposure to cold and wet, the larynx would become intensely congested and asthmatoïd symptoms would recur. In order to ward off such recurrences the patient was given a solution of adrenal substance in glycerin and water, and instructed to use it as a spray more or less constantly, following it with one of zinc sulphocarbolate in rose-water. When the solution of suprarenal substance preserved with chloretone was placed upon the market, it was substituted for the above glycerin extract. One night Solis Cohen was called in haste to the patient, whose appearance was different from that presented in ordinary attacks. The face was very much flushed, but dusky; the breathing was evidently painful, and there were slight inspiratory stridor; asthmatic râles were not evident, though the stridor made in the larynx was heard over the chest. Upon examination the uvula was seen to be swollen to about three times its ordinary size, evidently much distended with fluid. In color it was nearly white. The palate and half arches and a portion of the posterior wall of the pharynx were likewise markedly œdematous, and there was slight œdema of the epiglottis. The interior of the larynx, fortunately, was clear. The patient stated that he had sprayed the pharynx and nasopharynx very vigorously and for a prolonged period, possibly three or five minutes, with the suprarenal-chloretone solution. No effect upon the heart seemed to have been caused by the application. The uvula and palate were scarified in several places, but little fluid exuded, and scarcely a drop of blood. It was not deemed necessary to scarify the epiglottis. The patient was advised to keep at rest, a drastic purge was given, and gargling with lukewarm water, aromatized with toilet vinegar, was advised. In about an hour, whether spontaneously or otherwise, the œdema began to subside sufficiently to permit of greater ease in breathing; if, indeed, the visible œdema was the direct cause of the difficulty, and not merely an indication of a general condition of the respiratory mucous membrane which subsided with it. In about an hour more the patient was feeling very comfortable. Traces of the œdema of the uvula were visible for three or four days.

It will be again noted that the above condition was attributable to

¹ Medical News, October 5, 1901.

the extract of suprarenal substance with chloretone, and not to the adrenalin chloride solution now available. Solis Cohen adds that he has observed no ill effects from the latter or from the chloretone accompanying it, in various strengths from 1 in 1000 to 1 in 5000.

Formalin. Attempts to use this powerful antiseptic in rhino-laryngology have to some extent been interfered with owing to its irritating nature and the pain which its use has involved. This difficulty can to a great extent be overcome by using glycerin instead of water as a medium.¹ A strength of 1 to 4 per cent. is recommended. Although it keeps well without much diminution in strength for several weeks in a well-stoppered bottle in a cool place, it is better to prepare it fresh for use each time by mixing $1\frac{1}{2}$ to 5 minims of formalin with 2 fluid-drachms of pure glycerin. It has been recommended as an application in the nose for ozæna. As an application to the throat it is claimed by Jordan to have a considerable field of usefulness. A single application can be absolutely relied upon to kill every micro-organism with which it comes in contact. His bacteriological examinations prove this. The glycerin spreads readily over the surface beyond the immediate limits of its application; it conveys the formalin into the follicles of the tonsils and into the deep layers of the mucous membrane. In follicular tonsillitis in the early stages, while there are no deep collections of pus, formalin in glycerin (2, 3, or 4 per cent.) is a specific. After a single thorough application the temperature falls to normal within a few hours, and remains normal. The application is usually attended by a little soreness lasting only a few hours. For from half an hour to an hour after the treatment the patient should not be allowed to drink, the formalin being left undisturbed to exert its bactericidal action. After this a simple gargle, such as chlorate of potash, is all that is necessary. In diphtheria, in cases where the membrane is confined to the pharynx, formalin in glycerin is equally successful. In most cases, however, there is membrane in situations inaccessible to a brush—in the nares or in the air-passages. In such cases formalin in glycerin is of little use. In scarlet fever, where the throat condition is but a small part of a general disorder, one cannot expect much good from formalin; but even here 2 per cent. of formalin in glycerin every second or third day is certainly as good as any other local application. He also recommends it for parasitic and ulcerative stomatitis and tuberculous ulcers. For tuberculosis in the larynx it was recommended by Solis Cohen in 1896, and has lately been recommended by Lake.² He uses $\frac{1}{2}$ to 1 per cent. of the pure drug, or 1 to 10 per cent. of the

¹ Alfred C. Jordan. *Lancet*, February 16, 1901.

² Laryngeal Phthisis, London, 1901.

commercial product. He recommends not to use it in greater strength than 5 per cent. until the tolerance of the patient has been tested.

At the debate at the annual meeting of the British Medical Association, to be referred to later, there was no warm commendation of the drug, and most speakers still gave the preference to lactic acid when topical applications of an escharotic were required in tuberculous laryngitis.

Applications of Hot Air in Nasal Affections. In 1898 Vansant¹ described a method of relieving headache by forcible syringing of the nasal accessory sinuses with a stream of hot, dry air. In 1900 Lermoyez and Mahu² recommended the same method of treatment in a variety of affections of the nose, and its value has been further indorsed by Lichtwitz,³ who thinks that our therapeutic arsenal has been enriched by a method which promises good results, especially in cases of spasmodic and subacute rhinitis, and in certain cases of obstructive rhinitis where the block shifts from one side to the other of the nose. It is a treatment midway between too violent surgical measures and the too temporizing relief obtained from medicinal applications. It has the great advantage of being both harmless and painless. The treatment consists in introducing into the nasal cavity a current of dry air of a temperature between 70° and 90° C. Each treatment requires from 150 to 200 litres of air. The apparatus for producing this, originally made by Lermoyez and Mahu, has been usefully modified by Lichtwitz. He has made a pump worked by an electromotor, easily regulated, and producing a current of air under any pressure desired. The air is then passed through an arrangement for warming it. A description of the details of the arrangement would take up too much space, but readers can find full information in the references given. Mahu⁴ describes the excellent results which may be obtained with this treatment in certain children with hypertrophic rhinitis due to different causes. The treatments are given every other day, and last only two or three minutes. In the stage of congestion the mucous membrane is retracted under the stream of warm, dry air, and a watery flow of mucus is produced. This lasts from a few minutes to a few hours. With the retraction a certain amount of anæsthesia is produced in the mucosa, similar to the result obtained from cocaine; but the retraction, instead of being only temporary, tends with the progress of treatment to become permanent. Five to fifteen sittings may be required for this. In cases with decided localized hypertrophies, although this treatment will produce consid-

¹ Philadelphia Medical Journal, May 7, 1898.

² Annales des Mal. de l'Oreille, etc., July, 1900, xxvi., No. 7.

³ Ibid., April, 1901, xxvii., No. 4.

Annal. de Méd. et Chir. Infantiles, August 1, 1901, v., No. 15.

erable relief, it does not, of course, remove the necessity of surgical treatment.

The method seems worthy of a more extended trial. We have all been so carried away with the ease with which the galvanocautery does the work required of it, or the satisfactory results obtained by surgical procedures, that such suggestions of alternative plans of treatment are apt to meet with little attention at first.

GENERAL AFFECTIONS AND THE UPPER AIR-PASSAGES.

Gout. The positive diagnosis of gouty affections in the nose and throat is very difficult. It has been said that positive evidence is afforded either (1) by the presence of gouty manifestations elsewhere, or (2) by metastasis between anginal and arthritic attacks, or (3) by definite uratic deposits in the organ or tissues affected, or (4) by the affection resisting all other treatment except that with colchicum and iodides. Scanes Spicer¹ affirms that gouty manifestations in the nose and throat are exceedingly common, sometimes uncomplicated, but more frequently in combination with the local disorders of other origin, and that in order to cure the patient equal attention should be given to both the constitutional and local errors. He gives a very careful study of the whole subject. After quoting Luff, Morell Mackenzie, Dyce Duckworth, Lennox Browne, de Havilland Hall, Harrison Allen, and Thorner, he expresses his own views as follows :

“Gout usually manifests itself in the throat as a very chronic catarrh, with frequent subacute exacerbations. The catarrh is characterized by a dull brick-red or purplish coloration, with marked general engorgement, and dilated veins are seen in various positions. The mucous membrane is rough, thickened, often granular, and sometimes glazed. These changes are seen on the velum palati, the faucial pillars (especially the posterior) and the posterior pharyngeal wall. The tonsils are also abnormally red, enlarged, and harder than natural, but do not usually project much into the fauces. The uvula often shares in the hypertrophic condition, and is sometimes much elongated and œdematous, while the soft palate, as a whole, is relaxed and paretic. Behind the posterior pillars, and parallel to them, there are often rough, red, fleshy bands, running from above downward.

“There are often large varicose veins at the base of the tongue, with clusters of little spheroidal dilatations on them, together with general engorgement and hypersecretion, while the adenoid tissue of the lingual tonsils is hypertrophied to form hard, rough masses.

¹ Journal of Balneology and Climatology, November, 1900, vol. iv., Part 4.

"The epiglottis, aryepiglottic folds, and posterior half of the ventricular bands show a purple congestion, which is also seen on the posterior wall of the larynx, where the mucous membrane is often thrown into corrugated folds. The vocal cords themselves share in the hyperæmia; their surface may be dull and opaque instead of glistening, or a red, dry glaze may be substituted for the natural pearly lustre. Frequently a rough, warty condition over the vocal processes is seen on one side, forming a convex nipple fitting into a depression on the opposite side (pachydermia).

"Symptomatically this condition of the throat is characterized by a very marked increase of irritability and hyperæsthesia. In the pharynx and larynx sensations of itching, tickling, burning, scraping, and stabbing are common, and retching (especially in the morning when dressing), associated with paroxysmal cough; and profuse discharge of clear, frothy, tenacious mucus occurs more or less regularly for months or years. There are frequent recurrences of sore-throat under the slightest provocation, with follicular angina and quinsy at times. There is a chronic huskiness rather than hoarseness, and a tickling irritation of the larynx, leading to constant hemming and dry, hacking cough. This cough may be attended with the extrusion of a small pellet of clear, thick, viscid mucus. So irritable is the throat in some cases that the patient begins to retch violently on opening the mouth, and laryngoscopy is impracticable. Small hæmoptyses, from rupture of the little globular varices, are not uncommon, but are not of any great import. During the subacute exacerbations the larynx is the seat of great discomfort and soreness, the current of inspired air is unduly perceived, nocturnal spasm of the larynx (little doubt excited by buccal respiration and dryness of the parts) and typical attacks of laryngeal vertigo are not at all uncommon.

"This complex clinical picture of gout in the throat may be quite uncomplicated by structural disorders of the nose and upper respiratory tract or by any other disease of the area, though there can be little doubt that the gouty element is far more often superadded on to affections due mainly to other conditions, and modifying the course and manifestations of the latter."

In the nose, Scanes Spicer finds that gout is manifested by a chronic rhinitis of a hypertrophic type. Transient obstruction, especially at night and on the dependent side, is apt to occur without any trace of what would be termed a "cold." Attacks of sneezing, tendency to chronic rhinorrhœa, thickening of the vestibules, and various other conditions, though not by themselves in any way typical, are apt to be associated with rhinitis of a gouty nature. Subjects of gouty nose and throat catch cold on the slightest provocation. He lays stress on a

very characteristic feature of gouty affections of the nose and throat, and that is that the local application of cocaine gives comparatively little or no relief (or only a very temporary one) in reducing the symptoms of gouty catarrh; in fact, cocaine often increases the irritability and brings on sneezing, drip, or retching, as the case may be. The arterioles seem unaffected by the usual constricting action of cocaine. In the treatment of gouty catarrhs, astringents are generally of but little value as compared with salines and alkalies, but local treatment must also be carried out, as the diagnosis of the gouty diathesis must remain in many cases problematical. In the treatment of the gouty element, Scanes Spicer's experience is overwhelmingly in favor of a visit to a well-arranged spa. He points out the features which make Carlsbad and Marienbad the ideal resorts, but among others which are well known and variously suitable to different cases are Buxton, Harrogate, Bath, Leamington, Strathpeffer, Ems, Wiesbaden, Homburg, Vichy, Mont Dore, and many others.

Rheumatism. Although unable to adduce any new facts, I last year contributed a symposium on the relation of rheumatic fever to the throat.¹

TONSILLITIS AND RHEUMATISM. First of all I reviewed the literature referring to the idea that some forms of tonsillitis are due to rheumatism, and also that on the theory that rheumatic fever may be a septic infection from the throat. After weighing the arguments pro and con, it seemed that the present state of our knowledge on the relation of tonsillar affections to rheumatism might be summarized as follows:

1. It is undoubted that a certain number of cases of acute rheumatism are preceded by an angina in a proportion varying from 30 to 80 per cent.

2. Both rheumatism and angina have many etiological points in common—season of year, cold, wet, fatigue, depression, vitiated air, etc.

3. The connection of angina and rheumatism, though undoubted in a number of cases, is not yet clearly established.

4. The tonsil may be the port of entry of the rheumatic virus, and this even though the naked-eye appearance of the throat gives no indication of its being affected.

5. The particular affection of the throat which is associated with rheumatism is not yet established. Apparently it is not peritonsillar abscess (quinsy).

6. Peritonsillar inflammation does not appear to be arrested by the administration of antirheumatic remedies. Many cases of parenchymatous and lacunar tonsillitis, on the contrary, are considerably bene-

¹ Laryngoscope, January, 1901, and Practitioner, January, 1901.

fited by the administration of salicine or salicylate of soda. That this action proves the rheumatic nature of the disease cannot yet be accepted.

7. The question requires further research in two directions—one, in differentiating the various forms of angina and settling the one which is associated with rheumatism; the other, in further research to discover the true nature of rheumatism.

RHEUMATISM IN THE LARYNX. This subject has been investigated by Escat¹ in a paper containing numerous bibliographical references in addition to four personal observations. He thinks that the diagnosis of acute crico-arytenoid arthritis can be based on the following conditions:

1. The existence or pre-existence of acute catarrh of the pharynx and larynx.
2. A febrile condition.
3. Existence or pre-existence of other articular affections.
4. Dysphagia.
5. Dysphonia or partial aphonia.
6. Stridor, if both sides are affected.
7. Local pain, excited by cough.
8. Sharp pain on pressure along the posterior border of the thyroid cartilage.
9. Swelling, seen with the laryngoscope, over the arytenoid eminence.
10. Fixation on attempting to adduct the cord on the affected side, just as in recurrent paralysis; but the healthy arytenoid is not tilted forward on to the affected one, and (according to Grabower) the healthy vocal cord during adduction does not pass across the median line toward the other side.
11. Elevation of the cord on the affected side above the level of the horizontal plane occupied by the sound cord. (Ruault.)

Syphilis. Syphilis is sometimes of a malignant form in any part of the body. When it affects the upper air-passages it is always apt to be attended with such grave complications or sequelæ that I entirely agree with the opinion of Tissier² that in our treatment we should "*frapper vite et fort.*" In the hereditary manifestations of the disease in the nose and throat, especially in the late forms, the importance of active treatment is still greater. Toward adult life the patient has not only commenced to enjoy the possession of average health, but may have undertaken duties in the world the obligatory cessation of which would entail more wide-spread consequences almost than if he had remained crippled in his powers from childhood. A. P. Marfan³ comes to the conclusion that in the late hereditary serious manifestation of syphilis internal treatment with the "sirop de Gibert" is quite inadequate—one must have recourse to subcutaneous injections of soluble preparations of mercury, and his experience impels him to recommend weak watery solutions of cyanide of mercury; at the same time he gives

¹ Arch. Internat. de Laryng., January and February, 1901, xiv., No. 1, p. 9.

² Gaz. des Hôpitaux, 1896, Nos 20 and 23.

³ Annal. de Med. et Chirurg. Infantiles, August 1, 1901, No. 15.

iodide of potassium internally—as much as 30 grains a day for a child of ten years. The solution of cyanide of mercury is easily prepared, it keeps well, and when injected below the skin it causes less pain than the biniodide oil which has been recommended. Many have used the cyanide solution in a strength of 1 : 100. This provokes persistent indications, and Marfan advises a much weaker solution—one of 1 : 1000—prepared as follows :

Distilled water	100	gr.
Cyanide of mercury	0.10	centigrammes.

Ten c.c. of this solution contain 1 centigramme of cyanide of mercury. The injection is made, with every aseptic precaution, into the muscles of the buttocks, the back, or the thighs. If injected into or under the skin only an eschar is very apt to form. For an adult we may inject 5 c.c. every day, or 10 c.c. every other day, according to the indications. During treatment every care is taken of the mouth.

There can be little doubt that in many of the syphilitic affections of the nose and throat the internal administration of mercury is of little avail; while in others, though it produces a marked amelioration of symptoms, the treatment can hardly be called an eradicating one, and fails, in many instances, to prevent either recurrence of such sequelæ as retractions, stenoses, etc. I have already expressed my own opinion for the preference I give in all syphilitic diseases of the upper air-passages to the administration of mercury through the skin.¹ My experience is limited to administration by inunction, and in spite of some drawbacks this method has great advantages over intramuscular injections. The latter method is alarming to patients, and it is not always free from pain or from local discomfort. I have heard of serious results when studying the subject in Germany, although I cannot at the moment give any literary references; still I should not hesitate to employ it where the symptoms were particularly rapid and threatening, or where, as sometimes occurs, the attack is of such a malignant form that it is quite unaffected by inunction; but the latter should, in my experience, remain the method of choice. Iodide is given simultaneously by the mouth, according to the indications.

“SIROP DE GIBERT.” It may be useful, in parenthesis, to refer to the composition of the drug known in the French pharmacopœia as the “sirop de Gibert.” It is made as follows :

R.—Hydrargyri iodi rubri	gr. j.
Potassii iodidi	ʒijss.
Aquæ destill.	fʒj.
Solve et adde	
Syrup	ad fʒiv.

¹ Laryngoscope, January, 1898, vol. iv.

The dose of this is one teaspoonful in water. I have often found it useful as a remedy when desirous of keeping up a mild effect for some time, or when, for various reasons, it was necessary to treat a patient without disclosing the nature of his malady. Where the latter was not quite determined the "sirop de Gibert" can be prescribed under that name and used as a diagnostic test.

Tuberculosis. In Vol. I. of PROGRESSIVE MEDICINE for 1899 Dr. Logan Turner ably discussed the question of tuberculous infection through the pharyngeal and faucial tonsils. In Vol. I. for 1900, in connection with the subject, he considered the defensive mechanisms of the nose and development of tuberculosis in that organ. To the cases there recorded I have added another,¹ and several observations have been furnished by Continental and American rhinologists.² The situation of the granuloma in my own and other cases—generally in the anterior part of the septum—lends support to the view that its origin is really due to involuntary self-inoculation of the patient with his own finger-nail. An abrasion just within the nostril, started by the efforts to remove dust and inspissated mucus, would afford a vascular and favorable soil for any bacilli entangled in the vibrissæ and carried to the septum by the finger.

The occasion of the British Congress of Tuberculosis in London in 1901 further attracted both professional and public attention to a subject which is pregnant with so much importance to humanity and interest to science. In so far as the nose and throat are concerned, nothing striking on the subject occurred, but several communications during the year marked the state of present-day opinion and some of the influences which the modern methods of treatment have manifested. The subject of "Tubercular Infection through the Air-passages" was reviewed by St. Clair Thomson.³ In this the matter of primary tuberculosis of the nose and the defensive arrangements of the Schneiderian membrane were considered. We need not again refer to that side of the question. Some interesting experiments from Cambridge were quoted.

Renshaw⁴ has made a series of experiments on guinea-pigs by which he was able to show that the nasal mucous membrane may be infected by simply introducing sputum while leaving the membrane intact. Of eight animals used all showed signs of local irritation, and in seven

¹ Transactions of the Clinical Society of London, 1900, vol. xxxiii. p. 829.

² T. C. F. Theisen: Albany Medical Annals, March, 1898. Herzog: American Journal of the Medical Sciences, cvi. p. 677. Marc Goerke: Laryngoscope, May, 1899, p. 305. Bar and Lesuer: Rev. de Laryng., 1900, No. 39. Schmithuisen: Journal of Laryng., 1900, p. 397. Hasslauer: Archiv f. Laryng., 1900, Band x., Heft 1. Prota: Rev. de Laryng., 1900, xx. p. 443. Kiär: Rev. de Laryng., 1901, No. 9, p. 263.

³ Practitioner, July, 1901.

⁴ Journal of Pathology, February, 1901.

definite tubercular lesions were produced. It is noteworthy that from the nose infection of the meninges did not occur, nor was direct infection by way of the respiratory tract found; the track of invasion was in every case by the lymphatics to the glands, and from these to the viscera.

Renshaw expresses the opinion that, if looked for, many obscure nasal affections might prove to be tubercular. I cannot agree with him in this. All rhinologists are well acquainted with the symptoms of nasal tuberculosis, and although the disease is now known not to be as rare as it once was considered, still it is among the most uncommon manifestations of tubercle in the air-passages. An important suggestion, prompted by Renshaw's experiments, is that infection may take place through the nose without any local lesion. His observation is also noteworthy that the further the initial lesion is from the entrance to the nostril the more rapid, it seems, is the course of the disease and the earlier the invasion of other organs.

Further observations are quoted to show that infection through Waldeyer's ring may take place without any local lesion to mark the course followed by the bacillus.

Coming to the larynx, the question is considered why primary tuberculosis, though not unknown there, is so infrequent that it must be considered among the rarest of its manifestations. Although the larynx appears able to withstand almost any direct attack by the bacillus, yet when this germ has once obtained a footing in the lungs the larynx falls an easy prey to it. It would seem, as Jonathan Wright puts it, that "the bacillus must be baptized in the lungs and born again" before it is able to overcome the resistance of the larynx, or from the pulmonary vantage ground it must first sap the forces of general systemic resistance.¹ With regard to tubercular infection of the lungs, I have pointed out the numerous reasons for making us doubt that the bacillus can be directly carried along in the air stream until it is deposited in the pulmonary alveoli in its favorite location—the apices of the lungs. To do this it would have had to have successfully run the gauntlet of the stockades of ciliated epithelium in the nose, trachea, and larger bronchi; the mucus lubricating all the air ways and ever ready to enmesh and hinder the development of any organism, and the risk of being carried down into the stomach with the movement of swallowing, or ejected by those of talking or coughing. Should the invading organism successfully overcome all these obstructions, it would still remain a mystery why, once arrived at the division of a bronchus, it should turn upward against the force of gravity and in the direction

¹ Medical News, January 19, 1901.

where expansion is least marked, to take its final footing in the apex. After adducing other than *à priori* reasons against this route of pulmonary infection, I come to the following conclusions :

From various points of observation we are thus compelled to view with strong suspicion as a probably frequent focus of tubercular infection that ring of lymphoid tissue which surrounds the nasopharynx—the cross-roads where the food and air ways pass each other. So far as the faucial tonsils are concerned, infection could, of course, take place either from organisms deposited there (in mouth-breathers) by ingested food or by inspired air. In the nasopharynx it can only be on rare occasions that infected food can contaminate the “third” tonsil, better known under its everyday name of “adenoid growth.” On the other hand, the conclusions of Dr. Still concur in a remarkable manner with our own.¹ He forms the opinion that the commonest mode of infection is by inhalation, and he points out the frequency of tubercular infection of the middle ear. This opinion and this fact both coincide with our own conclusions, viz., that the commonest mode of tubercular infection is by inhalation, and that the inhaled bacillus has infected the system *before* the air current has reached the larynx—most probably through the lymphoid tissue of the nasopharynx and pharynx. There appears to be no justification for the generally accepted idea that the bacillus is inhaled directly into the pulmonary alveoli. This view, that the commonest form of tubercular infection was by inhalation, was more than confirmed by the great authority of Professor Koch, who, a few weeks later, announced his conviction that infection from animals—or, practically, from milk and meat—was a very remote contingency.

TREATMENT. Passing on to the question of treatment of tuberculous laryngitis, there has been a marked reaction against the excessive application of surgical measures applied with the purpose of eradicating the diseased tissue. The subject of local treatment formed the subject of debate at the annual gathering of the British Medical Association.² In opening it Middlemass Hunt affirmed that though the number of complete and lasting cures is still admittedly very small, it is no exaggeration to say that thousands of lives have been prolonged and an incalculable amount of suffering averted as a result of the work which has been done in this field. In my opinion, however, he took a limited view of the subject in stating that “curative treatment is essentially surgical. It means the removal of all diseased tissues by cutting instruments or their destruction by caustics, such as lactic or chromic

¹ Medical News, January 19, 1901.

² British Medical Journal, September 28, 1901 ; and Journal of Laryngology, October, 1901.

acid." This quotation reads as if Dr. Hunt does not look upon anything short of the knife or cautery as a curative treatment; yet at the ensuing debate I pointed out that rest is a method of treatment not scorned even by pure surgeons, who by securing complete rest of a tubercular hip or knee obtain results which are generally as good and more lasting than those obtained by pure surgical measures. Throughout the debate there was some tendency to regard tuberculosis of the larynx as if it were simply a local infection, requiring only local attention. But surely there is little satisfaction to the patient, and no credit to the profession, if while we cure a patient of tubercle in his larynx he dies the more rapidly of tubercular phthisis? The only result would be that, as a French teacher has put it, we could enter in our case-books a note to the effect that "il est mort guéri!" W. Jobson Horne said that the extreme surgical measures which had been advocated by some could not be regarded as remedial; at their best they were only mechanical means of overcoming physical difficulties which comparatively seldom occurred. Too much stress could not be laid on the important fact—which Dr. Horne has had good opportunities of observing as pathologist at the Throat Hospital and elsewhere—that by the time the larynx was so extensively involved in the disease as to require surgical treatment, cavity formation was already established in the lung; so that in treating the larynx for tuberculosis we are dealing with but a part of a diseased respiratory tract, and the need for general treatment must not be lost sight of. A moderate and yet progressive view was manifested by Barclay Baron, who also opened the discussion. He did not believe that local treatment alone will suffice to effect a cure, and it must always go hand-in-hand with general treatment. He had seen complete healing of tuberculous ulceration of the larynx where the open-air treatment was thoroughly carried out, the lungs and larynx healing *pari passu*, and where the local treatment was of the simplest character. He had never seen local treatment alone do this. He classified his treatment of the three stages of the disease as follows:

In the early stage of the disease, where we are dealing with a laryngeal inflammation, and where the inflammation, if any be present, is so slight as to make it very difficult to diagnose the condition from a simple laryngitis, our treatment should be of the mildest possible character. It should merely consist in giving such instructions to the patient as will give rest to the organ, and in every way should be that suitable for a simple laryngitis.

In the next stage of infiltration, speaking generally, we must shield the larynx from all irritation; for example, avoidance of too much voice use, irritating articles of food and drink, tobacco smoking, the

inhalation of irritating chemical substances, and of dust, as in various manufactures, handling vegetables, hides, etc.

The use of soothing and antiseptic substances inhaled—benzoin, creosote, menthol, etc., or sprays of menthol and guaiacol, or intratracheal injections of the same, is beneficial. Naturally, drugs that stop tickling, purposeless cough—especially codeine, cocaine, menthol, antipyrine, etc., in pastille or lozenge—are of value.

It is in the third or ulcerated stage of the disease that local treatment is most definitely valuable, because the application of surgical methods has enabled us to do a good deal to ameliorate the suffering, if not rid the patient of the disease.

The third opener of the debate, R. Lake, had given operative proceedings a wide trial, and stated as his conclusion that the wider one's experience of this disease the less frequently will one operate, but the more freely will one operate when one does so.

A noticeable feature of the debate was that some present who had formerly recommended submucous injections, and invented special instruments *ad hoc*, had nothing to say in commendation of such methods. The contraindications of surgical measures were given: First and principally, advanced and progressive tuberculosis of the lung, with high temperature, night-sweats, emaciation, etc.; secondly, acute inflammation of the larynx, especially perichondritis.

Among the alleviative measures suggested were insufflations of resorcin, one part, with orthoform, two parts; but the result of recent views evolved by the "open-air" method of treating phthisis was shown by the insistence of several speakers on the value of general and sanatorium treatment together with prolonged rest of the larynx.

Applications of lactic acid found several supporters, who advised that they should never be made over unbroken infiltrations, and that when applied to ulcerating surfaces they should be few and thorough, and at intervals of a week or so. Against this we must place the opinion of Freudenthal, who has used it freely, and now states frankly that "it ought to be dispensed with as an antiquated and barbarous torture of patients."¹

In 1899 Freudenthal subjected twenty-nine cases to surgical treatment without being able to record one single cure.² He then treated his cases of tuberculous laryngitis without curettage, and after a year's observations he wrote, "I believe my patients are just as well and perhaps better off than they would have been with the operation."³

The extensive and trustworthy experience of Jonathan Wright has

¹ Journal of the American Medical Association, March 16, 1901.

² Philadelphia Medical Journal, March 25, 1899.

³ Journal of American Medical Association, March 16, 1901.

led him to the following statement: "The permanent radical cure of the local lesion of tubercular laryngitis is not materially hastened by the various methods of treatment in any but an insignificant number of cases."¹

My own views, in the light of our present knowledge and therapeutic resources, have been so fully stated in a paper read at the British Congress of Tuberculosis that I can only give the summary of the conclusions I therein arrived at. They are as follows:

1. Pathology and clinical experience show that in the majority of cases the focus of infection is near or in the crico-arytenoid joint.

2. Many cases only present themselves at a stage when the possibility of effecting a cure by local measures is quite untenable.

3. The principle of *primum non nocere* should be constantly kept before us, as many measures which have been tried in this affection have only distressed the patient and hastened the disease.

4. In the light of present knowledge and therapeutic resources the most rational principle is to attempt to make an early diagnosis of the disease while in an incipient stage. Any persistent or suspicious laryngeal catarrh should be treated seriously on even a presumptive diagnosis.

5. Once diagnosed, the patient should be treated on the principles laid down in the modern method of sanatorium treatment.

6. Symptomatic treatment should be directed to any irritative, catarrhal, or obstructive condition of the air-passages.

7. In addition, silence should be enjoined, the disuse of the voice being proportionate to the degree in which the focus of infiltration approaches or interferes with the arytenoid joint.

8. In cases where the situation or extent of disease does not warrant an expectation of complete rest of the process, treatment should be symptomatic, and in many such cases the sanatorium treatment is uncalled for.²

The effect of pregnancy on laryngeal tuberculosis is generally known to be unfavorable. A. Kuttner³ has confirmed this by his investigations. The usual local treatment has always been unsuccessful, and the prospect of spontaneous cure, as long as pregnancy continues, must be excluded. When the disease is diffuse, tracheotomy may be required, and should this not work favorably in a few days artificial abortion should be induced. With advanced cases the attendant should hold himself in readiness to do tracheotomy during delivery.

¹ Medical News, New York, January 19, 1901.

² Journal of Laryngology, October, 1901; and Transactions of the Congress of Tuberculosis, 1901.

³ Archiv f. Laryngologie, Band xii., Heft 3; and Journal of Laryngology, November, 1901.

Acute Coryza. So numerous and so useless have been the remedies recommended for acute coryza that Gustav Spiess has had some hesitation in adding one to the thousand "certain remedies" which have already been published.¹ He has been struck with the observation that the nasal obstruction of a catarrh is much less troublesome at night than during the day. Is it to be ascribed simply to the even temperature maintained by the bed? Is it not more likely due to the diminished irritability of the vasomotors during sleep, when the swelling subsides and the secretion diminishes? Adopting this view, he looked around for some artificial means of reducing this irritability during the day. The internal administration of belladonna, quinine, antipyrine, salicin, and phenacetin may be helpful, the last two being preferred in medium doses. As to local remedies, the objections to cocaine are well known. While awaiting the ideal remedy, he suggests the use of orthoform. He points out that infection generally starts from the post-nasal space, in the remains of Luschka's tonsil, whence it extends downward, or forward, or in both directions. The insufflations of pure orthoform, or with equal parts of sodium sozoidolicum, must therefore be made through the mouth into the upper pharynx. It is useless to blow the powder into the obstructed nose. The applications must be made several times a day or even hourly. He has employed the method for two years, and can thoroughly recommend it. There are some patients with an idiosyncrasy against orthoform, which produces in them irritation instead of anæsthesia.

Nasal Catarrh. The management of nasal catarrh should not be beneath our attention. Charles Prevost Grayson² thinks that the first departure from the path of hygienic rectitude takes place in the gastrointestinal canal. The large majority of those who suffer from catarrhs of the respiratory tract will be found indolent as regards wholesome exercise, soft and overweight, and in all probability constipated. He regards the uric-acid diathesis as being not only a predisposing factor, but even the exciting agent. Naturally the principal features of his line of treatment are active catharsis and greatly restricted diet, vigorous outdoor and indoor exercise, and a hot bath every night. I would indorse his condemnation of the routine use of "rhinitis" and "coryza" tablets that are now having such a vogue. Instead of aiding elimination, their ingredients—opium, belladonna, aconite, etc.—greatly obstruct it, and are able to afford a slight alleviation of discomfort only at the expense of greatly prolonging the attack. Locally, he recommends an application of a weak cocaine solution, cleansing the nose with Dobell's solution, and then followed by a spray of adrenalin.

¹ Archiv f. Laryngologie, Band xii., Heft 1.

² Therapeutic Gazette, February 15, 1901.

In a few days restoration is promoted by a spray of the distilled extract of hamamelis, one part to three of water.

As a preventive of nasal coryza—distinguishing this, if one may, from catarrh due to local conditions—I feel convinced that nothing is so effective as fresh air. The evidence of this has been adduced over and over again, so that I would only point to the universal experience of sanatoria for consumptives, where “colds” are almost unknown. It might also be noted that in these institutions there is no frugality in the way of meals, but decidedly the contrary. Not that I would exculpate overeating as a predisposing cause, for in the sanatoria we must remember that it is to a large extent counterbalanced by the constant open-air existence.

Hay Fever still eludes the attempts of pathologists to state exactly what it is due to, and of therapeutists to deal with it successfully. The latter is so evidently dependent on the former that I must confess that the proposal of Holbrook Curtis¹ to try the effect of immunization, by giving internally and hypodermically the watery extract of certain flowers and their pollen, does not appeal to me very strongly. Still we cannot in every case wait for a remedy until the pathology of an affection has been determined, and such a strictly reasoning scientist as Huxley said that medicine was still so much an art and so little a science that he would rather be treated somewhat empirically than by one of your too correctly scientific physicians. Holbrook Curtis puts forth his suggestions so tentatively that, though based on our somewhat inadequate knowledge of the causes of hay fever, they are worthy of consideration. One patient informed him that it was impossible to go into the ipecac department of a drug house, where she was employed, without getting a “crying cold, with asthma,” and that when she worked in ipecac she had to take some tincture or syrup in drop doses for several days before she came in contact with the drug—a precaution which she found always prevented an attack. It was the remembrance of this case which originally suggested the possibility of an immunizing treatment of hay fever. The method is not only preventive, but will also allay an attack. It is particularly intended for ragweed corasthma. If his theory be correct, then this “rhinitis vasomotoria periodica,” or “corasthma ambrosiæ,” may be prevented by giving from two to ten drops of the tincture or fluid extract of *ambrosia artemisiæfolia* t. i. d. in water during the two weeks preceding the paroxysm. In cases entirely dependent on ragweed as an exciting cause Curtis concludes that 60 per cent. of the number treated may become immunized.

Epistaxis. Bleeding from the nose is so frequently, and in the large majority of cases so rightly, looked upon by the rhinologist as a

¹ Medical Record, July 13, 1901.

purely local affection, that it is well for him to remember that at times it is significant of serious systemic disease. Carl Kompe¹ points out that spontaneous epistaxis in individuals above forty years of age, which cannot be traced to one of the well-recognized local causes, is a suspicious sign of general arterio-sclerosis, and calls for a consideration of all symptoms of sclerosis of the vessels of the brain. If the ophthalmoscope confirms this, a fairly positive diagnosis of sclerosis of the brain vessels may be made, and from it of incipient softening of the brain. The same condition of the vessels of both the parts (the nose and the brain) is likely to exist, since they are branches of the same main artery. Before the first indication of sclerosis of the cerebral vessels appears, sometimes premonitory symptoms are observed, which give warning of the early approach of softening, due to arterio-sclerosis. All the early signs of arterio-sclerosis at the heart and periphery must be considered, as cardiac hypertrophy, aortic changes, tense radial artery, tortuous temporal arteries, etc. Vierordt had good results in these cases with the iodides combined with hygienic treatment.

NASAL POLYPUS.

Cause of Nasal Polypus. It is many years since Morell Mackenzie stated that the cause of polypus was unknown. I fear it still remains undetermined, in spite of a long discussion which was devoted to the subject by the Laryngological Society of London.² The chief result of this discussion was to once more throw upon the board the apple of discord with regard to Woakes' theory of "necrosing ethmoiditis," for Lambert Lack, the opener of the debate, practically revived Woakes' views by saying that "his theory of bone disease is the most adequate explanation hitherto offered of polypi, and especially of their tendency to recur." This view has been in past years vigorously combated by such pathologists as Hajek, Jonathan Wright, and others, who convinced themselves that inflammation of the ethmoid spread from the surface inward. Lack started to maintain the thesis that the ordinary nasal polypus is essentially a simple patch of œdematous mucous membrane—on which doubtless we are mostly agreed; and that this œdema is the result of disease in the underlying bone—on which we are very much divided. After describing the histology of nasal polypus—practically œdematous fibromata—he describes how there is clinically every stage between œdema of the mucous membrane and a polypus—a slight œdema, a

¹ Archiv f. Laryngologie, 1901.

² Transactions, December 7, 1900; Journal of Laryngology, February, 1901; and Laryngoscope, March, 1901.

marked localized œdema, a broadly sessile polypus, and then a typical pedunculated polypus. The bone changes he described as rarefying osteitis.

Diagnosis. It will be remembered that Woakes chiefly relied on the probe for the diagnosis of bone disease. Lack gives the following as some of the clinical signs :

1. Digital examination under general anæsthesia. If the finger be passed carefully up into the ethmoidal region in cases in which no operation has ever been performed, it often impinges on soft, jelly-like tissue in which spicules and loose pieces of bone can be plainly felt, although it is very rare to feel rough bare bone.

2. The probe may be used in a similar way, but it is obviously much less reliable. Very great care must be taken in employing it and in drawing deductions from its use. A blunt-ended probe and one which can be easily bent to pass in any direction must be used, and even then it is difficult to avoid perforating the softened mucous membrane. The ease, however, with which this is done, and the feeling of bare bone obtained, is quite different from the normal condition.

3. In a severe case of polypus in which no operative interference has ever been attempted, if the polypi be carefully removed with the snare without touching the bone in any way, it is sometimes possible to observe that the entire middle turbinate has disappeared and its place has been filled up by masses of small polypoid-looking growths.

4. The results of operations as regards recurrence when the diseased bone is completely removed. This further proves that the bone disease is the cause of the polypi, and not *vice versa*, as some have stated.

Treatment. Naturally, if the theory promulgated of the pathology of nasal polypus is accepted, the whole question of treatment must be reconsidered, for it is evident that simple removal of the polypi is quite insufficient without eradication of the diseased bone. After describing the treatment which may be sufficient in slighter forms of the disease, the following is the description of the method recommended in extensive ethmoid disease with recurring polypi : "The patient being anæsthetized, the ethmoidal region is thoroughly examined by the finger, both through the nose and also through the post-nasal space, to determine as far as possible the extent of the disease. If the middle turbinate be present it may be removed by means of the spokeshave, and any large polypi should be removed by means of the forceps ; then the lateral mass of the ethmoid should be thoroughly scraped away by means of a large ring-knife, such as Meyer's original adenoid curette. This is the only effective instrument ; sharp spoons are quite useless. In this way large masses of polypi, degenerated mucous membrane, and fragments of bone are removed. The finger is introduced from time to time to

observe the progress, to feel for any spicules of bone and soft patches, and the scraping is continued until all friable tissue has been removed. Healthy parts of the ethmoid are easily distinguished by the finger and even by the curette, as they are smooth, firm, resistant, and give little hold to the knife. In some cases the operation is completed by a smaller ring-knife, but this must be employed with the greatest care. Of course, great caution must be used when it is felt that the region of the cribriform plate is being reached, but the whole inner wall of the orbit may be scraped away with impunity. The operation should be performed with the patient turned well over on to his side, and in cases where the posterior part of the ethmoid is unaffected a large sponge may be pushed up into the post-nasal space. Directly the operation is over, hemorrhage is arrested by packing the nose with a strip of gauze soaked in glycerin-iodoform emulsion, and a piece of lint soaked in evaporating lotion is then applied to the face. This gauze packing should be changed every second or third day, and the nose irrigated. If it is easily tolerated it may be continued for a fortnight, in other cases it should be omitted earlier."

For this somewhat extensive operation permanent and satisfactory results are claimed, and the possibility of dangers was somewhat minimized. Here at once I would enter a warning protest. I have myself been present at the post-mortem on a case operated on in accordance with Dr. Lack's principles by a skilled rhinologist who took part in the debate and expressed his opinion on the complete safety of the method. Sir Felix Semon¹ has also reported that he has knowledge and details of a case in which death from acute meningitis occurred some three to four days after the operation in a patient who had, except for nasal polypi, been in good health. As twelve months have not yet elapsed since the above procedure was made public, two deaths is a very heavy toll to have paid for a method of treatment which, in addition to its dangers, is rough and haphazard, neglects the aid of the eye, and obtains no better results than those secured by careful removal of the diseased ethmoid with punch forceps under the control of the probe and inspection, and with the great assistance of adrenalin and cocaine.

It is unnecessary to go over the points which were raised by other speakers on this subject of nasal polypus. Some agreed with the method of operating and differed entirely from the pathology; others accepted both; some accepted neither. Among other points brought out in the debate were the avoidance of the galvanocautery and the risk of hemorrhage and collapse in operating on elderly people, even for simple polypi.

¹ British Medical Journal, November 9, 1901.

Outside criticisms have already appeared on the above debate on nasal polypi. Jonathan Wright¹ observes that it has been established beyond the peradventure of a doubt that bone disease frequently coexists with œdematous conditions of the mucosa; but he begs us not, at least for this once, in the history of modern rhinology, to rush to the untenable extreme of believing and acting on the belief that this is always the case. His criticisms should be read *in extenso* (pp. 407–409).

Ethmoiditis. While on the subject of ethmoiditis it is worth listening to the appeal of Clarence C. Rice² on the importance of preventing suppuration in the cavities of the ethmoid by prompt local treatment. He also reminds us that it is possible to produce a chronic suppurative ethmoiditis, and that this condition has frequently been caused by ill-advised nasal operations, or by operative work imperfectly performed, and even by simple medicinal treatment of the nasal passages which has been of too irritating a character.

THE TURBINALS.

In the valuable critique of Jonathan Wright, referred to above, he makes mention of the "spirit of ruthless destruction of the internal anatomy of the nose," evidenced in England a few years ago in the employment of the "spokeshave" for the ablation of the inferior turbinal. The reaction to this has set in; it was only a question of time for its appearance to be announced, and fortunately it has come comparatively early. The following are the words of Brown Kelly,³ of Glasgow, at the annual meeting of the British Medical Association: "The spokeshave or ring knife, as it was originally termed, was introduced for the removal of the hypertrophied posterior end of the inferior turbinate. This instrument might have retained an irreproachable place in our armamentarium had its use been restricted to that for which it was designed. Unfortunately, it found a wider application, and was modified in order to remove not only the hypertrophied mucous membrane, but the whole or greater part of the turbinated body. The operation of turbinotomy has not redounded to the credit of British rhinology, and at present I would merely have disclaimed any partiality for it had the suggestion not been made that the subject should form part of our discussion. The following may be mentioned as some of the objections to turbinotomy: 1. That in aiming at the improvement of certain functions it removes the organ chiefly concerned

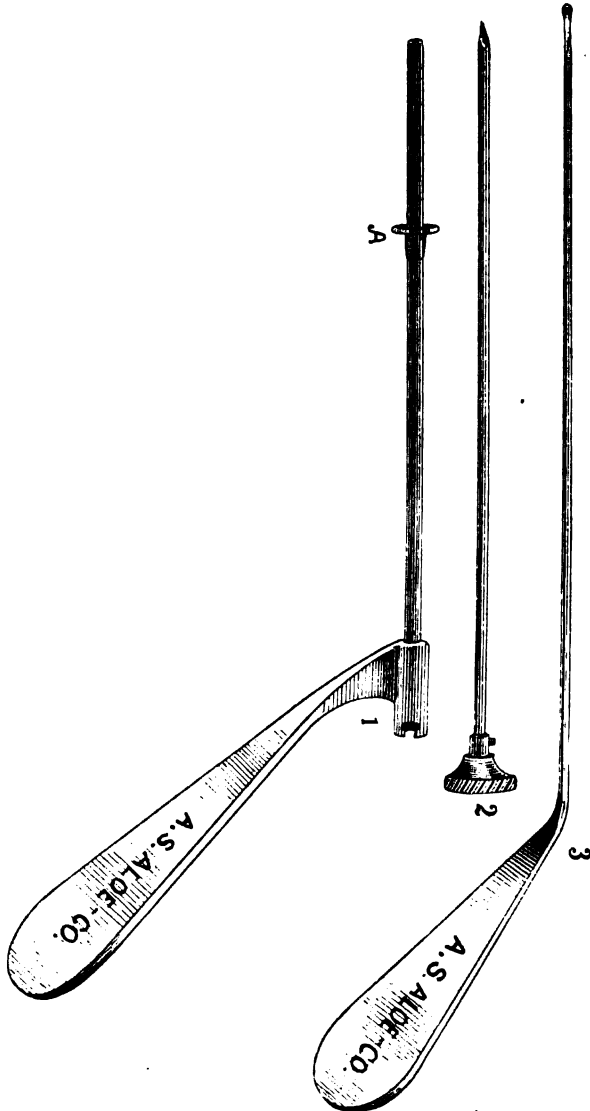
¹ Laryngoscope, June, 1901, vol. x., No. 3.

² Ibid., No. 6, p. 420.

³ British Medical Journal, September 28, 1901, p. 870.

in the performance of these functions. 2. That it accomplishes no more than can be attained by milder measures, and, I would ask, Which of us would submit to turbinotomy in preference to treatment

FIG. 2.



Goldstein's turbinal trocar.

by snaring or cauterization? 3. That there is the liability afterward to dryness of the mucous membrane of the upper air-passages. I am told on good authority that even ozæna may be a sequela, but of this I have no personal knowledge." And at the same meeting C. A.

Parker pointed out that it is never necessary to remove the whole of the inferior turbinate, as the anatomical widening of the middle part of the inferior fossa always allows sufficient room for both expiration and drainage. It will be noticed that in these words he mentions the use of the inferior meatus for "expiration." This is in conformity with his experiments already described, in which he shows that, though the inferior meatus should be kept patent for the purpose of drainage, inspiration chiefly demands a clear middle meatus.

Of alternatives to the spokeshave and other methods which are apt to do too much, we have the method of M. A. Goldstein, of submucous cauterizations.¹ A reference to the cuts of the instrument employed will help in explaining the proceeding. (Fig. 2.) After the application of cocaine a trocar is inserted into the hypertrophied turbinal, parallel to its length and hugging the bone, to a depth arranged beforehand by a sliding ring (*A*). On withdrawing the needle obturator (2) a probe bearing a bead of fused chromic acid is introduced along the trocar until it projects into the tissues. It is then slowly withdrawn along with the trocar, and so forms a long, submucous cautery track. This method is simple, free from pain, has no untoward after-effects, and does not destroy physiologically vital tissues. There is no fear of synechiæ.

THE ACCESSORY SINUSES OF THE NOSE.

The surgery of these adnexæ of the nose has been so thoroughly considered in previous volumes of *PROGRESSIVE MEDICINE* that, in spite of an immense amount of valuable work which appeared on the subject in 1901, I can but refer to a few papers.

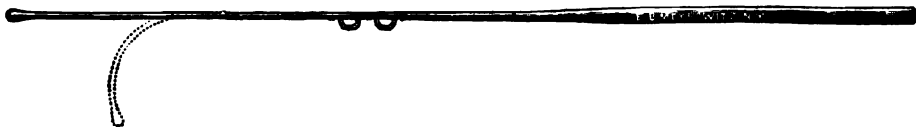
Frontal Sinus. In connection with this cavity Walter A. Wells points out that in view of the dependent position of its ostium we might have supposed that simple irrigation through the nose would have sufficed and radical measures be less often required. Unfortunately, this method of treatment has fallen somewhat into neglect. He lays down as a general proposition that in all cases of frontal sinus suppuration, where we cannot be certain that polyps, granulation tissue, necrosis, or other chronic changes are present, we should, before proceeding to the radical operation, make an attempt to cure by irrigation through the natural opening. The best guide for this is the uncinate process, and when the probe, carried just behind the prominence, fails to engage in the canal, it will do so when reintroduced immediately anterior to it. A probe bent to a little more than 90 degrees, and about 30 mm. from the end, is the one which enters with the greatest facility

¹ *Laryngoscope*, May, 1901, vol. x., No. 5, p. 325.

in most cases. (Fig. 3.) A probe thus shaped and measured off in centimetres, when so introduced as to have its point just reaching the floor of the sinus, was in contact with the anterior border of the floor of the nose at a point which averaged, in cases examined, 6 c.m. from the end of the probe. With the probe here figured, and observing all the necessary precautions, Wells has been able, in a series of forty-two cases taken at random, to enter the frontal sinus twenty-eight times. In but two of these had the middle turbinal been removed. In case of its removal (anterior end) the proportion of successes would doubtless be increased to 75 or 80 per cent.¹

Sphenoidal Sinus. Forty years ago Hyrtl² stated that the sphenoidal sinus was beyond any manual or instrumental intervention. This has ceased to be the case, although it is true that this sinus is the last to withstand the incursions of the enterprising rhinologist. Chronic sup-puration in this cavity was the subject of debate at the annual meeting of the Société Française d'Otologie,³ where it was introduced by F. Furet. The debate marked no new departure, the most striking point of it being the proposal to gain access to the front wall of the sinus by

FIG. 3.



first traversing the maxillary antrum. This had previously been carried out by Jansen and Luc. It is not likely to gain many supporters, and we await with interest more reliable methods of securing drainage for this cavity.

Meantime, investigators are giving considerable attention to the surgical anatomy of the sphenoidal sinuses. A valuable paper on the "pneumatic sinuses in the sphenoidal wings" has appeared from the pen of Beaman Douglas.⁴ It is impossible to give an adequate epitome of these anatomical researches, but their value and instructiveness is great, and we refer those who are interested in the matter to the original article.

Antrum Disease. Dr. D. A. Kuyk,⁵ of Richmond, Va., calls attention to the use of the tuning-fork in cases of antrum disease where the

¹ Laryngoscope, April, 1901.

² Topographie anatomique, Band i., Wien, 1860.

³ Bulletins et Mémoires, May, 1901.

⁴ Laryngoscope, vol. x., February, 1901.

⁵ Ibid.

diagnosis is obscure. By testing with the fork over the antrum and first and second molars, "if the antra are free and clear the tuning-fork (C. and Co.) will be heard with equal distinctness and for a like duration over each side and in either location. If one antrum contains fluid the fork will not be heard so distinctly, perhaps faintly, perhaps not at all; if the opposite antrum is free the patient replies quickly and positively in the affirmative." The author notes that the same method may be applied to cases of frontal sinus disease, and perhaps ethmoid disease, and certainly it is of use in mastoid disease. He appeals to his *confrères*, especially those who have unlimited clinical material, to corroborate his results.

THE TONSILS.

Recurrence after Excision. This is not as vexed and as frequently asked a question as that of the recurrence of adenoids after removal. It is generally believed that it never happens. F. E. Hopkins¹ quotes a case in support of the view that it does happen occasionally, perhaps once or twice in five hundred to six hundred cases. My own experience confirms this. Although rarely met with, I have known of hypertrophied tonsils recurring not once but twice in a boy, aged twelve years. The first time they were removed by a most expert colleague. With the first recurrence the boy, aged about eight years, was brought to me, and I was careful to excise them as thoroughly as anyone can with a guillotine. All went well for a time, but in a few years after an attack of scarlatina he was brought to me again with tonsils which, though not large enough to be threaded through the loop of a tonsillotome, were yet sufficiently hypertrophied to require *morcellement*.

Hemorrhage from Tonsillar Abscess. Hemorrhage from a tonsillar abscess is so rare that the following case by Dr. W. F. Chappell² is of interest. A man, aged twenty-seven years, had two attacks of quinsy in the past two years, each resulting in an abscess which had to be opened. A third attack began on December 1, 1899, with great pain in the right side of the throat, extending down the neck. He was under treatment for five weeks, during which time four incisions were made, with little relief. He then went to the hospital with great swelling of the neck, which was evident both internally and externally, and an abscess pointing in the middle of the posterior pillar of the soft palate. A small incision was made and about half an ounce of foul pus escaped. Pus continued to discharge and the swelling diminished. On

¹ New York Medical Journal, December 2, 1900.

² Ibid., March, 1901.

January 21, 1900, four days after the abscess was incised, he complained of sudden severe pain in the throat. In a few minutes about six ounces of blood were lost. The hemorrhage ceased on the application of tannic acid. Four hours later a hemorrhage of about eight ounces occurred, and was arrested by an astringent gargle. The urine contained much albumin, epithelial and pus cells, and granular casts. On January 26th hemorrhage to the extent of eight ounces occurred in the morning. In the afternoon the tonsillar and cervical tissues were distended and painful. Blood was still oozing from the opening in the posterior pillar, and the abscess cavity was filled with clots. A large incision was made through the anterior surface of the soft palate and carried backward until the abscess cavity was reached. After washing out the clots with hydrogen peroxide solution the ascending pharyngeal artery was seen at the outer posterior wall of the cavity. No ulceration could be discovered in its walls. The cavity was packed with iodoform gauze. The packing was changed daily for ten days, the wound healed, and no further hemorrhage occurred. Dr. Chappell has found in the literature of the subject reports of ten cases, of which only two terminated in recovery. The first case was reported in 1825 by Dr. Samuel Walker. There was double tonsillar abscess. The left abscess opened spontaneously. There was a swelling in front of the thyroid cartilage, which on being opened was found to communicate with the right tonsillar abscess. Two days later the patient died from great hemorrhage, the blood gushing from the mouth and nose. The second case was reported by Dr. Thomas Watson in 1828. Two days after a tonsillar abscess had been opened twelve or fourteen ounces of blood suddenly gushed from the throat and nose. The hemorrhage recurred on the same day and on the following days. Two weeks later bleeding took place after eating, and while preparations were being made to tie the carotid artery the patient died from suffocation. The necropsy revealed the trachea and bronchi full of blood, and a large erosion of the lingual artery. In almost all the cases the abscess opened spontaneously, and probably an early incision would have prevented the extensive ulceration which implicated a large vessel. Dr. Chappell recommends immediate ligation of the carotid artery on the occurrence of the first hemorrhage, or, as proved successful in his case, a free incision through the anterior wall of the soft palate and firm packing of the abscess cavity with gauze.

To these cases one was shortly afterward added by William Hammond and C. C. Lord.¹ A peritonsillar abscess ruptured spontaneously, and two days later some hemorrhage from the throat commenced.

¹ British Medical Journal, May 11, 1901.

This slowly abated, but not for three weeks. It then ceased for two or three days, but only to come on again and defy all attempts to arrest it. Finally the common carotid was tied, and although the patient was in a very low state, she made a satisfactory recovery. Now it is to be noticed that in the case here reported there was no hæmophilic tendency, and the abscess had ruptured spontaneously. The operator remarks that in a similar case, although no cerebral disturbance occurred in this case from ligaturing the common carotid, he would in a similar case tie the external carotid and place a temporary ligature around the internal, to be tied if necessary. An interesting paper on the subject of hemorrhage from the internal carotid will be found in *St. Thomas' Hospital Reports*, by Bernard Pitts.

Primary Chancre of the Tonsil. Cases of this have been recorded by Peter Abercrombie,¹ W. H. Kelson,² S. G. Dabney,³ and John E. Rhodes,⁴ three cases. In the first two observations the tonsillotome was suspected as the carrier of infection. Dr. Rhodes' paper again calls attention to the frightful contagiousness of syphilis and to the frequency with which it is carried to innocent persons.

Tonsillotomy Rash. Wingrave⁵ records thirty-four cases (eight of which have occurred since publication), in seven years, of "tonsillotomy rash" associated with removal of the tonsils and adenoids. The small percentage is accounted for because many cases are merely reported by parents as having had a rash, and therefore further systematic investigation in all cases after tonsillotomy or adenoid removal would probably show a greater percentage. In three instances out of the thirty-four the rash proved to be scarlatinal, and one of the cases developed diphtheria, but the remaining thirty were simple non-specific rashes. The eruption appears on the second or third day about the neck, chest, and abdomen, and after lasting from two to three days disappears without desquamation, but is often accompanied by itching. It is either papular, roseolar, or erythematous in type, and may occur at any age, being noticed twice as often in females as in males. Generally the constitutional disturbance is but slight, the temperature rising 1° or 2° F. The recognition of the condition as following these operations is of importance in preventing the formation of a graver diagnosis. The fact that scarlet fever occurred in three cases and diphtheria in one has an important practical bearing upon the practice of removing actively inflamed tonsils, as advised by many surgeons, because of the following advantages: (1) Greater facilities in using the guillotine presented by the inflamed

¹ British Medical Journal, September 21, 1901.

² Ibid., October 26, 1901.

³ Medical Times, September, 1901.

⁴ Proceedings of the American Laryngological Association, May, 1901.

⁵ Laryngoscope, July, 1901.

tonsils ; (2) the more thorough removal and the relief of angina. The possibility of tonsillotomy occurring in a case of an unrecognized specific fever is not regarded as giving additional risk, but it is doubtful whether this view can be taken if adenoids are removed at the same time, because of the increased denuded surface presenting a large area for the absorption of toxic matter. Blood examination during the week following operation shows an increase of mononuclear white corpuscles, rarely lasting beyond the tenth day. As most of the cases were taking potassium bromide and sodium salicylate, the rash may be one of drug intolerance ; but, whatever its pathology, the knowledge that such a non-specific rash may occur will be a reassurance to practitioners meeting with it for the first time.

OZÆNA.

It is distressing to see how ozæna baffles both the pathologist and the therapist, in spite of an immense amount of work devoted to the subject. Pasmanik¹ believes that his observations upon twenty cases of ozæna throw some light upon the disputed question of the pathology of the disease. There have been advanced at different times six theories to account for the origin of ozæna. Certain French and German pathologists have considered ozæna not as a separate disease, but as a symptom of suppuration of the nasal sinuses. In most cases, however, the nasal sinuses have been found healthy. Again, ozæna is, above all, a disease of childhood and early adult life ; sinusitis occurs generally at an advanced age. Moreover, if, as Tissier stated, the primary lesion is situated in the ethmoidal cells, the atrophy and crust formation should be most marked over the superior part of the nasal mucous membrane ; but all observers are agreed that the inferior third is most involved. Störk regards ozæna as a consequence of syphilis. Pasmanik found no evidence of syphilis in any of his cases. Trousseau points out that ozæna is a non-ulcerating process, while syphilis is essentially an ulcerating disease. The third hypothesis is that fetid atrophic rhinitis is the last stage of a purulent rhinitis ; but purulent rhinitis may persist for twenty to forty years, causing more and more obstruction of the nasal passages without any sign of atrophy. Pasmanik can only find one case of such transformation of hypertrophy into atrophy recorded in the literature. The neuropathic theory seems to be an inversion of occurrences. Ozæna causes neurosis rather than neurosis ozæna. The bacterial theory is not fully satisfactory. The

¹ Rev. Méd. de la Suisse Romande, April 20, 1901. Epitome, British Medical Journal.

mucous bacillus, described by Abel, has been found in the purulent secretion below the crusts, but never actually in the tissues. It can cause the catarrhal inflammation then, but not the atrophy. The atrophy can hardly be due to the pressure of the crusts, for it is most marked in the lower part of the nose, where there is most room. The true explanation, Pasmanik believes, is to be found in a combination of the bacterial and the anatomical of nativistic theories. The last supposes that ozæna is caused by an abnormal conformation of the nose, especially of the nasal bones, which is innate and sometimes hereditary. In ozæna the nose is almost always found large and flat, the so-called platyrrhinia. This platyrrhinia is usually associated with the brachyprosopic face. It may, however, occur with the leptoprosopic face as a result of nasal traumatism. In 15 of Pasmanik's cases the platyrrhinia was marked. The other 5 cases occurred at a more or less advanced age, and in these the atrophy and the fetor were but little pronounced. In 14 cases the onset occurred before adult life. Twice Pasmanik has been able to trace ozæna through three successive generations. In 2 cases the appearance of crusts was seen to be preceded by a short suppurative stage.

Many organisms in addition to the bacillus mucosus of Löwenberg and Abel have been credited as the cause of ozæna. Stein¹ has bacteriologically examined the nasal secretions of 86 patients, 51 of whom were the subjects of ozæna and the other 35 either healthy or suffering from other diseases. Abel has drawn attention to the infectious character of the disease, the frequency with which it is found in more than one member of the same family, and the progress to neighboring organs as a process of auto-infection. The disease is very insidious in its commencement, the first symptoms attracting the patient's attention being often some nasal obstruction and a disagreeable smell. Stein relates the histories of a mother and two children in whom the infectious nature of the disease was well illustrated. The parts most commonly affected secondarily are the middle ear and the larynx. In one case where the disease spread from the left to the right nostril, Stein was able to study the early changes. The mucous membrane was swollen and reddened, and scattered over it were small round foci about the size of a lentil, consisting of mucofibrinous material and containing the *B. mucosus* in pure culture. In his investigations the author has classed all cases as ozæna in which the characteristic secretion and the atrophic signs were present, irrespective of the presence or absence of fetor. The latter must be considered secondary. Excluding organisms found in healthy noses and those found very rarely in the cultures, two types were frequent, the *B. mucosus* and a bacillus resembling the *B.*

¹ Centralb. f. Bakt., December 15 and 20, 1900, Band xxviii.

diphtheriæ. The gonococcus believed by Störk to be a common cause of the disease was not found. The bacillus resembling the *B. diphtheriæ* is identical with that described by Belfanti and Della Vedova as the cause of the disease, but is again identical with a certain organism frequently found in the secretion from healthy throats and noses. Except for its possessing no pathogenic properties it closely resembles the *B. diphtheriæ*. It was not present in 26 out of 51 cases of ozæna, and cannot be considered the cause of the condition. The organism described by Perez is considered by Stein to be one of several which are only concerned in the production of the fetor secondary to the real pathological process. With regard to the bacillus mucosus, it was found in 44 out of the 51 cases of ozæna. Of the 7 negative cases 5 were only examined once, and in 3 of these a bacillus resembling the *B. mucosus* was found microscopically, but not in culture. In the 2 other cases forms considered as in all probability involution forms of the bacillus were found. Stein considers it in the highest degree probable that this organism is the real cause of the disease; it is not the cause of the fetor, for pure cultures do not exhibit the characteristic smell. The opinion of Bayer, that the disease is originally a tropho-neurosis, is discussed, also that of Cholewa and Cordes, who, although they consider that the *B. mucosus* is inseparably connected with the disease, do not accept its causal relationship, and believe the first changes to occur in the bones and to be of the nature of osteomalacia. Stein considers that his researches combined with those of Abel argue that the disease is an infective process dependent on the activity of the bacillus mucosus.

First in the *Annales de l'Institut Pasteur* (December, 1899), and lately in a separate brochure, Dr. Fernand Perez has published a long study in which he demonstrates that ozæna is due to the cocco bacillus fœtidus ozænæ, which is only present in man during this disease, though, on the other hand, it is met with as a normal condition in the nasal mucus and saliva of the dog, in which it can increase and assume a special virulence and contagiousness under the influence of any inter-current disease. He would therefore consider the disease as infectious not only from man to man, but also from the dog to man. After intravenous injection of the microbe, Perez has been able in the rabbit to reproduce experimentally an acute rhinitis followed by atrophy of the turbinals. If this evidence of contagiousness is confirmed, it would entail two primary indications: The avoidance of close contact between dogs and human beings—particularly children—and between subjects of ozæna and the healthy. Handkerchiefs and other objects soiled with discharges from the nose in ozæna should be disinfected and the nasal fossæ kept as well cleansed as possible.

ATROPHIC RHINITIS.

The Treatment of Atrophic Rhinitis by electrolysis received renewed attention last year. Carolus M. Cobb¹ came to the following conclusions :

1. Electrolysis has a curative action in atrophic rhinitis in so far as it stops the tendency to crust formation and the odor in typical cases.

2. It does not stop the discharge or the odor if these are caused by nasal empyema.

3. That better results are obtained if the needles are placed comparatively near together.

4. That it makes no difference in the result what metal is used for needles, and it therefore follows that the diffusion of the copper salt is evidently not the curative agent.

5. That the improvement in the condition of the nasal mucous membrane is most noticeable in the area around the positive pole.

6. That this improvement is probably due to the liberation of oxygen and chlorine, and the chemical change resulting from the presence of free oxygen and chlorine in the tissues or the acid reaction produced thereby.

7. That the needle of the negative pole should not be placed beneath the membrane of the septum.

This does not appear to me to be a very brilliant result to attain to after the time, trouble, pain, and even danger attending the treatment. In truth, the above paper did not meet with much enthusiasm at the annual meeting of the American Medical Association, for J. F. Culp stated that he knew of cases which had been spoken of in the highest terms as cured by this remedy which had relapsed in a very short time after the publication of the paper reporting them.

Imbued with the results claimed by McBride,² fifteen cases have been submitted to this treatment by Eugene S. Yonge,³ but with what appears to me indifferent results. No permanent cure is claimed, but the benefits are said to be superior to those secured by any other method of treatment.

The teaching of Grünwald has, I think, done more for ozæna than any of these researches after a specific cure. To him we are chiefly indebted for the lesson that a large number, possibly the majority, and certainly 50 per cent., of the cases which ten years ago we would have diagnosed off-hand as "ozæna" are really cases of suppuration in the accessory cavities, and therefore amenable in a very large number of instances

¹ Journal of the American Medical Association, March 16, 1901.

² Edinburgh Medical Journal, March, 1899.

³ Lancet, November 9, 1901.

to the surgical measures which have been evolved in recent years. Certain it is that in my own clinic, with an attendance of 100 to 150 patients, it is now quite rare to find a case of true ozæna. Possibly one or two might be found attending in an afternoon along with five to ten cases of sinus disease. I cannot agree to any sweeping generalization such as that all cases of ozæna are due to suppuration in the accessory cavities. The fact that atrophic rhinitis is most common in late childhood, and more common with females than with males, is against such an idea; but, while not going further into the question here, I would only record my conviction of the frequency with which sinus disease is mistaken for ozæna. I fear that the cure of true ozæna must await the determination of its pathology.

NASOPHARYNGEAL ADENOIDS.

The Breaking of an Instrument at any time during an operation is unpleasant, but when the sharp portion of a Gottstein curette, large or small, breaks off in the vault of the pharynx of an unconscious or struggling child, with most excellent chances for the broken piece to either pass into the larynx or stomach, the case assumes an unpleasant aspect.

An unpleasant accident of this character occurred to C. R. Holmes,¹ but he was fortunate enough to extract the broken portion from the post-nasal space.

In some instruments the cause of breaking is probably due in a measure to imperfect tempering of the steel, but the chief cause is that in forging the curettes there is too sharp a shoulder made where the blade begins at A. (Fig. 4.) In others the blades are made thinner than need be in the first place, and repeated sharpenings often bring them down to much below the point of safety. A second case, by H. S. Garlick, is reported in the same paper. In this instance the fragment was swallowed. It caused no symptoms, and was passed per rectum three days afterward.

I note with surprise that in this latter case the operation was being carried out without a general anæsthetic on a child aged five years. It is, of course, not unusual in some Continental countries to see this necessarily alarming looking operation performed without an anæsthetic, but among the more generally sensitive and refined inhabitants of the Anglo-Saxon race I should have thought that such an idea would not nowadays be entertained. However rapidly executed, the removal of adenoids is necessarily painful if thoroughly executed, and I do not

¹ Laryngoscope, May, 1901, vol. x.

think it is right to expose a child of five years to the possible severe mental shock entailed by it, when a short anæsthesia in competent hands necessitates only an infinitesimal risk.

Conditions Simulating Adenoids. The various morbid conditions which may simulate adenoids have been studied by Wyatt Wingrave.¹ Now that the so-called "classical symptoms" are so generally recognized, children are frequently sent up for operation without having had the post-nasal space either inspected or palpated. Again, the so-called "adenoid facies" may persist after complete removal of adenoids and tonsils, and in such cases the parents are not only apt to be disappointed, but may be persuaded that the operation was not satisfactorily performed.

FIG. 4.



Excluding those forms of nasal obstruction readily recognized by anterior rhinoscopy, the morbid conditions symptomatic of adenoids may be thus grouped: (1) Diminutive choanæ and nostrils; (2) low vault of nasopharynx; (3) paresis of soft palate and pharynx; (4) vomerine crest; (5) distortion of vertebral column; (6) retropharyngeal abscess; (7) hypertrophy of palate tuberosities; (8) webs and neoplasms.

Changes in Facial Bones Due to Adenoids. That certain changes in the facial bones are attributable to adenoids is a view generally held by rhinologists and again supported by A. T. Mitchell.² The imposed necessity of mouth-breathing during the years preceding ossification would afford an apparently adequate explanation of the arching of the hard palate, the approximation of the lateral alveolar

¹ British Medical Journal, September 28, 1901; and Journal of Laryngology, 1901.

² Journal of the American Medical Association, July 27, 1901.

arches, and the throwing forward of the premaxillary bone bearing the incisor teeth. But there are other points to be considered. Not only have the dental surgeon and the nerve specialist their point of view and an explanation to offer which appears to them satisfactory, but we have to remember that cases are on record where the adenoid facies was well marked, although no growths were discoverable even during childhood. (Escat.¹) The case is well put by Castex, when he said: "*On peut parître adenoidien sans l'être, comme on peut l'être sans le paraître.*"

Breathing Exercises. Under the title of "Faux Adenoidisme" the functional symptoms of what might be termed "adenoids when there are no adenoids" have been described by Natier² in an article in which he shows that in certain cases the external symptoms indicating the presence of adenoids may in reality be due to respiratory defects in a neurotic subject. Attention to the general health and regulated respiratory exercises were sufficient to cause the disappearance of these symptoms.

There is some evidence of a disinclination on the part of the public to have adenoid growths removed, although causing obvious symptoms calling for operation. In its place they are substituting "breathing exercises," in which there is quite a society "boom" at present. Sir Felix Semon³ has done well by asking pertinently on what grounds are "breathing exercises" expected to act beneficially in genuine hypertrophy of lymphoid tissue? If it is by the air being forcibly drawn over them, how is it, he asks, that in so many cases of much-developed adenoids there are at the same time much-developed tonsils? These latter are exposed to the air current, not for half an hour three times a day, as recommended in "breathing exercises," but all day and all night for many months or even years! Yet the enlarged faucial tonsils show no tendency to decrease under it, although in structure they are so very similar to adenoids. The cases in which brilliant results are claimed for breathing exercises in causing the disappearance of adenoids doubtless occur in those instances in which there is only some temporary catarrhal inflammation of the normal Luschka's tonsil—an enlargement which would have subsided under ordinary treatment. "Breathing exercises" are most valuable in their proper place, but, as Semon shows, we must not put the cart before the horse. The time for enforced nasal respiratory exercises is after, and not before, operation for a growth which requires removal.

¹ Arch. Internat. de Laryng., 1891, 1896, No. 3.

² La Parole, June 6, 1901.

³ British Medical Journal, November 2, 1901.

HÆMOPTYSIS OTHER THAN PULMONARY.

"*Sanguinem superne quidem efferi, qualiscumque sit, malum,*" said Hippocrates, and there is no doubt that the appearance of blood is always alarming both to the patient and to his friends. As the spitting of blood immediately raises the suspicion of tuberculosis—and very rightly, unfortunately, in the majority of cases—it is important to differentiate those instances in which it originates elsewhere than in the lungs. Cases of laryngeal bleeding unprovoked by some local cause are exceptionally rare, and in a search through the literature of the subject since 1890 George B. Wood¹ has been able to find only six cases; Terras,² Geraert,³ Lubet-Barbon,⁴ von Geyer,⁵ H. S. Straight⁶ (two cases). He records a case in which the exact bleeding-point could not be detected, although streaks of blood were seen in the pharynx and larynx. The veins of the gums, pharynx, and larynx were dilated, and the patient had marked oxaluria. The lung-sounds were normal and the health good. He comes to the following conclusions: It is not inconceivable that in this case there may exist some slight tubercular formation in the lungs, unprogressive, but sufficiently active to cause the rupture of a small bloodvessel; but the probability of such a condition seems for the following reasons infinite in its minuteness: 1. No recognizable symptoms of tuberculosis could be detected. 2. The blood, though apparent in the trachea, was evidently running downward and not upward, existing as a small, narrow streak on its anterior wall. 3. The blood was expectorated easily, without cough. 4. The point of bleeding was thought to have been just below the anterior commissure in the last attack, and on the anterior end of the left vocal cord at the author's first visit. 5. The temporary cessation of bleeding following the application of suprarenal extract.

The bibliography of George B. Wood is evidently incomplete, and were it to pass without comment it might lead readers to imagine that hæmoptysis in non-tuberculous subjects was a rarer occurrence than it really is. I cannot here do more than refer to a few of the instances I have in my memory. Thus David Newman⁷ publishes no less than six cases in which hæmoptysis was believed at one time to be due to tuberculous disease of the lung, while ultimately it proved to be the result of a lesion in the upper air channels. These cases were under

¹ American Journal of the Medical Sciences, May, 1901.

² Soc. Franc. de Laryng., May, 1895.

³ La Belgique Méd., 1895, No. 42.

⁴ Journal of Laryngology, 1898, p. 149.

⁵ Münchener med. Wochenschrift, April, 1898.

⁶ Journal of Laryngology, 1899, p. 91.

⁷ British Medical Journal, May 29, 1891.

observation for three years or more, so that any error in diagnosis is almost certainly obviated. Besides, in every case the bleeding-point was discovered—sometimes only after repeated and careful examination. Again, Massei¹ devotes one of his masterly contributions to the subject of chronic hemorrhagic tracheal catarrh; and Pisenti² also describes two cases of tracheal hemorrhage in the same journal for October, 1899. Other cases could be quoted if necessary, but these are sufficient to show that the bibliography has by no means been exhausted in the paper referred to, and that laryngeal bleeding is not, therefore, so exceptionally rare.

The Pseudo-hæmoptysis of Nasopharyngeal Origin is studied by Botey,³ who comes to the following conclusions: Special literature does not sufficiently insist upon the occurrence of this form of hæmoptysis. Hemorrhages from the larynx, base of the tongue, and pharynx are relatively infrequent compared to nasopharyngeal bleeding. The source of the blood seen on the pharyngeal wall can be determined if one will clean the wall with a cotton carrier and then apply a fresh carrier behind the soft palate, when it will be at once covered with fresh blood. Bleeding in the vault is favored by the close attachment of the mucosa to the parts beneath, and the comparatively poor protection of the epithelial layer. The use of cotton as above described, together with the employment of the mirror, renders diagnosis easy. These methods of examination should never be omitted in cases of hæmoptysis when the chest reveals nothing abnormal.

LARYNGEAL GROWTHS.

Laryngeal Cancer. One is almost inclined to think that such an erudite laryngologist as John N. Mackenzie overlooks some of the literature on this subject when he contributes a paper to the 1900 meeting of the American Laryngological Association bearing the significant title "A Plea for Early Naked-eye Diagnosis and Removal of the Entire Organ, with the Neighboring Area of Possible Lymphatic Infection, in Cancer of the Larynx." Semon⁴ lends his authority to apostrophizing Mackenzie's paper as "the worst exaggeration that has ever, to his knowledge, been perpetrated in connection with affections of the upper air-passages." Semon points out that, at any rate, Mackenzie has at least the courage of his opinions, since, in all earnestness, he considers the naked-eye diagnosis a "comparatively speaking neglected method," emphatically

¹ *Archivii Italiani di Laringologia*, October, 1898.

² *Ibid.*, October, 1899.

³ *Annal. des Mal. de l'Oreille*, January, 1901.

⁴ *British Medical Journal*, November 9, 1901.

rejects the removal of a piece for microscopical examination, and demands—however early the diagnosis may have been made, however limited the disease may be—not only “early total extirpation of the entire organ,” but even of its “tributary lymphatics and glands, whether the latter are apparently diseased or not,” as “the only possible safeguard against local recurrence or metastasis.” After these astounding performances Semon would like to give Dr. Mackenzie the benefit of the doubt and assume that, Rip-Van-Winkle-like, he must have slept through the whole modern development of our knowledge of laryngeal cancer, particularly as he declares that “thyrotomy with curettement of all apparent (visible) disease is not up-to-date surgery, is in direct defiance of the rules that should govern us in the treatment of cancer, and is a reversion to and a resurrection of a method of procedure which was abandoned and discredited over half a century ago.” Semon finds it difficult to take as serious Mackenzie’s advice to condemn to a very serious and mutilating operation patients whom we have learned to cure by infinitely milder methods. What these methods are, and what are the results they have obtained, can be found by a perusal of Dr. Logan Turner’s article in *PROGRESSIVE MEDICINE* for March, 1901.

Thyrotomy for Removal of Laryngeal Growths. The reference to thyrotomy leads me to refer to the unconsidered haste with which some practitioners incline to this method of treatment for laryngeal growths in children. The reasons for rejecting it are well brought forward by Hunter Mackenzie,¹ who holds that a more unsatisfactory method of treating children could hardly be devised. Apart from the risks attendant upon its performance—such as permanent alteration or impairment of the voice, chronic stenosis of the larynx, and sometimes death—it is invariably followed by recurrence, more often by recurrences, and frequent repetitions of the operation, usually at very short intervals, are necessary. Some striking examples of this have been put on record. Lendon reports its performance seventeen times within two years in a child, and eventually a stenosis of the larynx ensued which necessitated the permanent use of a tracheotomy-tube. Abbe opened the larynx four times in a child suffering from suffocating laryngeal papillomata, removed the growths, and cauterized their seat of origin. Notwithstanding this extremely radical treatment, they continued to recur, and eventually tracheotomy had to be resorted to. Another case has been recently recorded by the same surgeon, with the following operative history: Tracheotomy and thyrotomy; two months afterward a second thyrotomy; a few months afterward a third thyrotomy; then a fourth thyrotomy; and, finally, a second tracheotomy. In this country Permewan mentions the case

¹ British Medical Journal, September 28, 1901.

of a boy, aged eleven years, whom two complete thyrotomies, with thorough cauterizations of the affected parts, failed to cure. The growths recurred for the third time, and although to all appearances he had not attained a condition of urgency, he was found dead one morning of asphyxia. Walker Downie had a two-year-old child in whom thyrotomy had to be performed six times in one year.

Endolaryngeal Removal of Growths. Turning now to the treatment by endolaryngeal removal, this, even in the most expert hands, is not remarkably successful. Thus Hovell had to operate fourteen times under chloroform in order to clear the larynx of a boy, aged three and a half years, at that time the youngest on record. But this pales before Stoker's case, that of a patient, aged thirty, who from the age of seven had suffered from papillomata in the larynx. During this period (and before coming into Stoker's hands) he had been operated on by one man 100 times and by another 120 times. He then seemed to awake to the consciousness of the fact that he was occupying more than his share of professional time and skill, for he invested in the necessary armamentarium, and thenceforth performed his own operations! Bond has recorded the case of a girl, aged eighteen years, in whom, since she was ten years old, papillomata had been removed every two months, amounting to nearly fifty operations. Some may consider these cases extreme examples of recurrences of growths and multiplicity of operations, but with the exception of Stoker's case they may be taken as fairly representative of the results of this branch of endolaryngeal surgery in children.

Tracheotomy for Laryngeal Growths. Hunter Mackenzie gives the preference in treatment to simple tracheotomy, and states that those cases showed the best results in which neither thyrotomy nor endolaryngeal operation had been performed. Since the publication of his first case confirmatory cases have been recorded by the following, among others:

Massei,¹ case of papilloma of the larynx, in which, after tracheotomy, the vegetations in the course of a year disappeared in a wonderful way. "In stenosis due to papilloma, tracheotomy is not only an admirable palliative, but also a radical treatment."

Garel² (two cases), girl, aged four years; tracheotomy on June 11th; tube removed on July 30th; voice perfect. Boy, aged eleven years; papillomata of epiglottis and larynx; tube removed after two years; tracheotomy strongly recommended.

Oertel³ (two cases), quoted by Hoffmann.

¹ Internat. Centralbl. f. Laryng., Jahrgang x. p. 362.

² Annales des Malad. de l'Oreille et du Larynx, June, 1891.

³ Sammlung klin. Vorträge, No. 315, p. 2807.

Railton¹ (two cases), aged three and four years ; growth appeared also at tracheotomy wound ; these were shaved off and ultimately atrophied ; tubes used for three and a half and two and a half years.

Eliasberg² (one case), boy, aged twelve years ; thyrotomy twice, with removal of the vocal cord on which the growths were situated ; recurrences ; tracheotomy ; canula removed after three months ; no recurrence after two years.

White³ (one case), boy, aged six years ; growth removed *per vias naturales* several times ; recurrences, with suffocative attacks, which necessitated tracheotomy ; subsequent attempts to remove the growths resulted in increasing the neoplasms. When all operative efforts ceased the growths began to disappear, and the boy is now quite well ; tracheal growths also disappeared ; tube worn for five years.

Cowgill⁴ (one case), child, aged six years ; spontaneous recession of laryngeal papillomata after tracheotomy ; tube worn for three years and eight months.

Chappell and Gleitsmann⁵ (one case), girl with larynx full of papillomata ; tracheotomy ; spontaneous disappearance of all the growths in five months.

Baumgarten⁶ noticed a remarkable diminution of papillomata in nearly every case after tracheotomy.

Carmichael⁷ (two cases), not yet reported, but authorized to be quoted in this paper.

In performing the tracheotomy care should be taken that the cricoid cartilage is not cut through, for then the tube might come in contact with and irritate the growths which occur below as well as on the vocal cords.

Although agreement is not universal on the desirability of trusting to tracheotomy alone for the treatment of laryngeal papillomata in children, or at least until they reach such an age that they can assist in instead of resisting endolaryngeal manipulations, yet it seems generally agreed that thyrotomy (laryngo-fissure) should be avoided.

From a case recorded by F. L. Wachenheim⁸ the DANGERS OF INTUBATION FOR LARYNGEAL PAPILLOMA are well brought out. A child, aged two years, had suffered from dyspnoea for more than a year. The only active treatment resorted to had been intubation. This had

¹ British Medical Journal, February 19, 1898.

² Journal of Laryngology, vol. v. p. 245.

³ Ibid., vol. vi. p. 486.

⁴ Philadelphia Medical News, October 4, 1890.

⁵ Journal of Laryngology, vol. ix., p. 355.

⁶ Internat. Centralbl. f. Laryng., Jahrgang xv. p. 249.

⁷ Dr. James Carmichael, Consulting Physician to the Royal Hospital for Sick Children, Edinburgh.

⁸ Medical Record, March 23, 1901.

been tried for several weeks, with no apparent result except to increase the child's distress. When brought to the author a provisional diagnosis of laryngeal papilloma was made, although a laryngeal inspection was not possible. The parents neglected to bring the child back for admission, and it died rather suddenly, apparently from strangulation. A post-mortem showed the following condition :

The lumen of the larynx was exceedingly constricted, barely admitting a probe ; the epiglottis was folded tightly and drawn backward. The mucous membrane in general was apparently thinned and anæmic, especially over the anterior surface, without any local redness. The right vocal cord was represented by a small, uneven nodule, the left cord was largely replaced by a warty, friable mass of about the size of a very small pea. There were cicatricial depressions below the arytenoids. The ventricles and false bands were quite obliterated. In spite of the almost total disappearance of the cords themselves the glottis was practically closed by the general constriction of the surrounding parts and the very moderate-sized tumor. The trachea was entirely free from pathological changes ; the thyroid body was of normal size. (See Fig. 5.)

After reviewing his own case and the literature on the subject, Wachenheim pertinently asks, "Why not perform tracheotomy at once, and then operate on the tumor or tumors at leisure?" He draws the following conclusions :

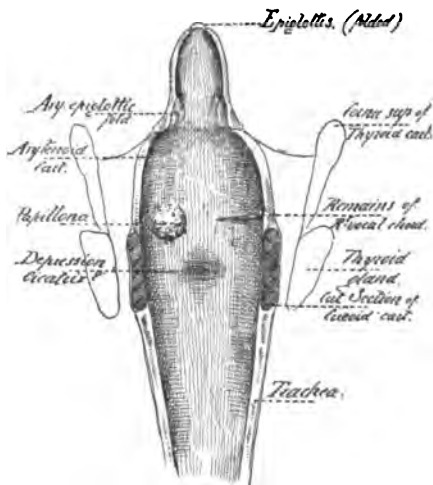
1. Intubation is not to be employed indiscriminately whenever there is a laryngeal stenosis ; tracheotomy is not yet obsolete.

2. In chronic laryngeal stenosis in children we must bear in mind the frequency of papilloma.

3. Prolonged intubation is always perilous, with special risks in cases of obstruction by tumors.

These conclusions I would heartily endorse.

FIG. 5.



Section in median line.

OTOLOGY.

By ROBERT L. RANDOLPH, M.D.

EXTERNAL EAR.

Othæmatoma of Syphilitic Origin. It may be interesting to recall the fact that othæmatoma is most frequently observed in the insane, and that the term is usually applied to a peculiar swelling of the auricle, which is either due to the effusion of blood between the cartilage and the perichondrium or to an effusion into the substance of the cartilage. The pathology of the disease, according to Buck,¹ is rather obscure. The fact that it is usually seen in the insane has given rise to the opinion that it is due to a pathological condition of the brain. It is well known, too, that violence has been regarded as an important etiological factor, and the reason why it is seen more frequently in the insane is because the insane are very liable to violence. According to Ludwig, Meyer, Pollak, and others othæmatoma is not a pathological lesion of insanity, but it is due to the surroundings of the insane and to the debilitated condition of these unfortunates. It is a condition, then, in which malnutrition plays an important part, and we know that malnutrition probably reaches a higher grade among those who are insane than among those who have healthy minds.

According to Bishop, the most satisfactory treatment is incision and swabbing out the cavity with a 5 per cent. aqueous solution of carbolic acid, insufflating with aristol, and applying a compress. Randall cures the wall of the sac, rubs with iodine glycerite, and packs with iodoform gauze. Such, then, is a brief glance at othæmatoma as we usually meet with it.

The probability of such a condition being due to syphilis has occurred to no one so far as I can ascertain, and I can find nothing in the literature in this connection. It seems, however, that Zeissler² has met with a case where the tumor of the auricle was due to syphilis. The subject was a physician who had infected himself from one of his patients, and who showed in six weeks the characteristic eruption. He was treated vigorously, and the eruption promptly disappeared. Some months later,

¹ Manual of Diseases of the Ear, p. 56.

² Journal of Cutaneous and Genito-Urinary Diseases, February, 1901.

without any apparent cause, an othæmatoma formed on the right ear. Several punctures were made, but the tumor re-formed. In despair as to its etiology, he tried the iodides, and the swelling rapidly disappeared. Six months later the patient showed symptoms of Ménière's disease, and at the same time he had tingling and burning sensations in the fingers of the left hand. The conclusion reached then was that he was suffering with syphilitic disease of the base of the brain, and this was the cause of the symptoms just enumerated and of the othæmatoma. The view taken by Zeissler rather strengthens the opinion of Brown-Séquard in this connection, for it is well known that the latter has succeeded in producing hæmatoma of the auricle in certain animals by section of the restiform body.

THE MIDDLE EAR.

Suppurative Processes. We all know the close relationship which exists between acute nasal and pharyngeal inflammations and suppurative processes of the middle ear. We also know that adenoids and hypertrophied turbinates may lead to inflammation of the middle ear. There is, however, a form of adenoids which frequently does not attract our attention because it produces few of the symptoms which are peculiar to adenoids, such, for instance, as mouth-breathing; but, for all that, it is responsible for recurrent attacks of otitis media suppurativa. In these cases the patient breathes perfectly, though he may be subject to attacks of cold in the head which are temporary in character. Dr. P. McBride¹ has called our attention to these cases, and emphasizes the importance of relieving the pharyngeal condition. An examination with the mirror will reveal a layer of adenoid tissue occupying the space between the Eustachian orifices and apparently pressing upon their margins. Digital examination will fail to show any great quantity of lymphoid tissue. In such cases the removal of what we find will usually be followed by a cessation of the attacks of ear trouble.

The same author alludes to two conditions which, in his experience, justify one in looking for trouble, and I am disposed to agree with him, as I have met with several such cases. The conditions are met with after perforation has occurred, and sometimes after a free incision of the tympanic membrane: 1. Excessive discharge. 2. A small pouting perforation and a bulging membrane. In this class of cases we are very apt to have recurrent attacks of pain, especially when the rupture of the membrane has been a spontaneous one. In these cases we will nearly always find mastoid pain, and I believe that an operation in the large majority of cases will reveal a mastoid process more or less

¹ *Lancet*, May 18, 1901.

softened, infiltrated, and full of granulation tissue, a condition which extends right into the antrum.

As I stated in my last year's report,¹ we are more apt to have this experience in otitis media following la grippe. I am still of the opinion that either politzerization or catheterization is contraindicated while suppuration is in progress, though McBride advocates both measures when there is no recognizable infective secretion in either the nose or in the nasopharynx, and when drainage is difficult owing to the small size of the perforation. I believe, though, that bacteria may be forcibly driven up from the tympanum to the antrum, and deeper still by the pressure from either of these procedures, and that even if the nasopharyngeal region were free of recognizable infective material (which is unlikely), the presence of suppuration in the tympanic cavity would be reason enough for withholding either the catheterization or the Politzer method. I cannot say that I have seen a case where mastoid complication was directly traceable to this method of treatment, but I have met with more than one case where there was decided pain in the mastoid region a few hours after the inflation, and I have abandoned the latter absolutely in treating the otitis media of la grippe.

Camphoroxol and Menthoxol in Suppuration of the Middle Ear.

How often we meet with cases of chronic suppurative inflammation of the middle ear where all our usual remedies fail and where we must think of a possible radical operation! New remedies are always welcome, and the communication of Hotz² on camphoroxol and menthoxol is worthy of notice. The new remedies are combinations of peroxide of hydrogen and alcohol, with either camphor or menthol. They have a pleasant odor and great deodorizing power. They are not irritating, and are very stable. Peroxide of hydrogen, as we know, is immediately decomposed as soon as it comes in contact with the secretion of wounds or of mucous surfaces. When used alone its disinfectant effect is very transient, while it is claimed for camphoroxol and menthoxol that after it has done its germicidal work there remains on the surface of the wound a substance, camphor or menthol, which continues the disinfection and prevents a new invasion of microbes.

Professor Stetter, of Königsberg, has used these so-called "oxols" with marked benefit in a case of otorrhœa where all known remedies had failed to remove the profuse and fetid discharge. Hotz used the product in solution of equal parts of water and camphoroxol, and with the direction that it be dropped into the ear twice daily. He also injects the camphoroxol into the middle ear through the catheter. He

¹ PROGRESSIVE MEDICINE, March, 1901, p. 412.

² Therapeutic News, vol. ii., No. 1.

reports several cases where this method of treatment was employed, and in all with benefit. In one case the classical symptoms of mastoiditis were present; that is to say, redness, swelling, and great tenderness over the mastoid, accompanied with violent pain in the head, and high temperature. An injection was made through the Eustachian catheter and the middle-ear cavity well flooded with the solution, which latter was instilled twice daily into the external ear, and in three weeks the ear was "perfectly well." The author reports the successful use of the same agent in a case of *aspergillus nigricans*. The patient was cured in three days.

The So-called Cones of the Drum Membrane. It will be remembered, perhaps, that Katz, Schwartz, and Politzer have described this rather rare condition as one which is found with acute suppurative inflammation of the middle ear. Recently Bezold¹ has made a contribution to the subject, and he discusses more particularly the histopathological structure of these little proliferations. It may be interesting, first, to know something of their clinical characteristics. The condition seems to be a proliferation of the border of the perforation in cases where the suppuration has continued for some time. It is really a proliferation within the tympanic cavity of the mucous membrane, which appears to push itself forward over the border of the perforation, and which resembles a small granuloma. It is interesting to note the fact that when this excrescence is removed it shows a perforated centre corresponding to the hole in the tympanic membrane. Very frequently the excrescence reappears after removal. Bezold has observed them very often after the otitis of influenza. The chief clinical characteristic of this structure seems to be a canal which perforates its centre. The condition, according to Bezold, is more often seen when the perforation is located in the upper posterior quadrant of the drum membrane. It is also of interest to learn that this cone-like proliferation is only seen in individuals who are otherwise absolutely healthy. In other words, Bezold has never observed this peculiar condition in otitis after measles, scarlet fever, typhus, pyæmia, erysipelas, etc. The treatment which has been adopted for this class of cases is removal with the snare—that is to say, whenever they are quite large. In 1131 cases of acute inflammation of the middle ear Bezold observed this condition sixty-nine times.

Further Observations on Vibratory Massage. Last year I alluded to the work of Breitung, who treated successfully chronic aural catarrh by a method known as electro-massage. Ostmann took up the method, and reported three cases in which the disease had been

¹ Archiv f. Ohrenheilkunde, Band li., Heft 4.

pronounced incurable, and in all three improvement resulted. Lucae, it will be remembered, prefers the hand masseur, because it has the additional advantage that each stroke of the masseur can be controlled by the hand.

Recently, Lucae has been going into this matter more exhaustively, and presents us with some new thoughts. He has been employing a method which he calls *hydropneumatic massage*, and, in addition, he gives an account of results obtained with the pressure method.¹ He performs *hydropneumatic massage* by interposing a small chamber containing water between the tympanic membrane and the tube which conducts the air. He describes the apparatus which he has devised for this purpose. He found that the method had decided advantages over other methods of pneumatic massage. Some patients claim that the method is pleasant. There is generally a slight tickling sensation, which sometimes amounts to actual pain, but the patients soon accustom themselves to this, as the pain is usually of very short duration. Sometimes there is slight dizziness, but this symptom is also transient. It is interesting to note the fact that in cases of deafness in both ears the noise produced by the apparatus is not heard as distinctly in the ear which is at the moment being treated as in the other ear. Generally speaking, the objective changes as a result of the application are insignificant, with the exception of a more or less considerable injection of the tympanic membrane. The sittings should last from one to three minutes. Lucae reports quite a number of cases where both the pressure sound and the ordinary pneumatic massage had been employed unsuccessfully, and where the *hydropneumatic massage* had produced marked improvement. Like most of these methods, it is evident that the fresher the case the better the prognosis, and while, no doubt, good results will follow its use, it is improbable that the method will prove pre-eminently valuable in the majority of cases of middle-ear sclerosis.

Lucae has found that the majority of his cases were functionally helped to a considerable degree, as was proved by their ability to hear both the watch and the whisper, and, as regards the subjective noises, he notes more marked improvement than from the pneumatic massage. The same author has modified his treatment with the pressure sound in that he now communicates the force to the sound through the agency of an electric battery. The treatment is probably a little more irritating than either of the other methods, and I doubt whether it possesses any advantages over them. Pneumatic massage has certainly done a good deal of functional and psychic good in the past to this unfortunate class of people, and newer methods for its application are always in

¹ Archiv f. Ohrenheilkunde, Band li., Heft 1.

order, though I seriously doubt whether there has been any substantial advance in this domain during the past year, and in this opinion I am to some extent fortified by a recent communication of Ostmann¹ and also by Schwabach.²

Both of these observers have made frequent contributions to this subject. The authors took great care, before beginning the treatment (to which I referred in my last year's report³), to make functional examinations immediately before and after the massage both with the voice and with the continuous tone series. He noted well the effect of this kind of massage on the subjective noises. The following troubles were not included in the tests—acute inflammation of the middle ear, diseases of the perceptive apparatus, and cases in which the apparatus of transmission was healthy. The simple forms of chronic catarrh of the middle ear, with considerable displacement of the malleus handle, and tympanic adhesions. The class of cases which were subjected to the tests were, first, patients in whom there was deafness resulting from partial destruction of the apparatus of transmission, cases of sclerosis of the middle ear, chronic hypertrophic catarrh of the middle ear, and those in whom the deafness was due to the so-called cicatricial inflammation, or catarrh of the middle ear. From these experiments (as I stated a year ago) it seems to me that vibratory massage has rather a limited field of usefulness. In sclerosis of the middle ear it is practically useless in so far as restoring hearing is concerned. Sometimes we see the subjective noises diminished, though one case is reported in which subjective noises were produced by the treatment, and that, too, in a case where there were no subjective noises before, and the noises thus produced persisted for hours. In another case the trouble seemed to be aggravated by the treatment. The treatment seems to be more efficacious in the hypertrophic variety of middle-ear catarrh. In this class of cases there seems to be an enlargement of the auditory field, which enlargement, even if it did not enable the person to hear the spoken voice, at least rendered somewhat easier the perception of the low notes.

In the face of such results it is difficult to see in what respect the method is superior to pneumatic massage. It may, however, be regarded as an important auxiliary method of treatment in certain ear troubles, and should always be tried when other methods have been shown to be ineffectual. Sclerosis of the ossicular chain, in which condition vibratory massage has been particularly recommended, seems to be benefited less than other troubles of the middle ear. It is prob-

¹ Zeitschrift f. Ohrenheilkunde, Band xxxix., Heft 1, 1901.

² Ibid., 2, 1901.

³ PROGRESSIVE MEDICINE, March, 1901.

ably more suitable in cases of pronounced deafness, with subjective noises, and, while it does not often produce improvement in the hearing, it usually lessens the subjective noises which are so tormenting, and this it does, according to Schwabach, in a very pronounced manner.

The method seems to be indicated in subacute catarrh of the middle ear, in the sequels of acute otitis media following la grippe, and in chronic suppurations of the middle ear. Schwabach thinks that the method can be tried in doubtful cases where the site of the lesion has not been diagnosed exactly. In 40 per cent. of cases of this character Schwabach obtained a diminution in the subjective noises, and in 7 per cent. an improvement in the hearing. In pronounced primary idiopathic affections the method is probably useless. In certain cases of simple catarrh of the middle ear, either acute or chronic, the combination of massage and catheterization gives good results when either alone produces no effect.

Tinnitus Aurium. The last few years have witnessed several substantial advances in otology, but little or no progress has been made in the treatment of tinnitus aurium. This symptom means that we have either some lesion of or interference with the function of the sound-receiving apparatus or of the sound-conducting apparatus. In the treatment of this obstinate condition much can be accomplished by careful attention to the nose and throat. Again, I would like to call attention to the superior efficacy of gargles in many of these cases over sprays. We often have a relaxed and flabby condition of the mucous membrane and tissues, generally about the palate, pharynx, and entrances to the tubes, and there is nothing which, in my experience, helps more than the simple gymnastics of gargling. The very exercise strengthens the tone of the tissues in this part of the throat, and, I am sure, contributes materially to the patency of the Eustachian orifices, certainly more so than either spraying or mopping. The gargle from which I have gotten considerable satisfaction has the following formula :

R.—Tinct. iodi	f 3j.
Potassii iodidi	3 ij.
Vini gallici	f 3j.
Aquæ	q. s. ad. f 3 iv.

Sig.—Two teaspoonfuls of this mixture in a half-glass of water and used as a gargle three or four times a day, using about a mouthful at a time for each application.

All of these cases require inflation of the tube, and as my experience grows along these lines the more I am convinced that catheterization, and not politzerization, should be employed. General practitioners are very prone to the use of the Politzer bag, because they are seldom sufficiently familiar with the proper use of the catheter. I believe

that in cases requiring inflation much harm has been done by the injudicious use of the Politzer bag. I might go further, and say that the Politzer bag is not the proper instrument for the general practitioner; but that, if he is going to practice inflation of the tube, he should familiarize himself with the use of the catheter as being far less likely to do harm, and, in every sense of the word, more to the point. The catheter is far gentler, and with it we can send a current of air with more directness and, at the same time, avoid the necessity of inflating the other ear, which may be a healthy one, and, as we know, this often happens when either the Valsalva method or politzerization is employed. Flabbiness and relaxation of the drum membrane has been permanently produced by treatment with the Politzer bag in the hands of those who are not aurists.

The question arises, How often is it necessary to practice catheterization? Twice weekly seems to me sufficient for all purposes, and after this has been carried on for six weeks or two months it should be discontinued, and an interval of say from four to six weeks be allowed to elapse before the catheter is resumed. Massage of the drum membrane will sometimes be of value in releasing adhesions. I have never tried the method of electrical dilatation as recommended by Duel, to which I have alluded in a previous report, but this method looks promising; neither can I report success from the use of strychnine. It seems to me that I have seen decided benefit from the use of pilocarpine. I employ it in the form of tablets, $\frac{1}{100}$ grain each, and have the patient take one three times daily. Of course, this remedy can be used hypodermically, and then it should not be given in more than $\frac{1}{2}$ -grain doses, and no oftener than every other day. I have kept a patient, however, for as long as three months on the tablets of pilocarpine, and in some few cases decided benefit resulted. The remedy which has given equally as good results is thiosinamine, in doses of $\frac{1}{2}$ to 1 grain three times daily. Sometimes I have given as much as $1\frac{1}{2}$ grains three times daily. The remedy is supposed to have the power of softening cicatricial tissue. It is readily soluble in water, and I usually give it in a 3-ounce mixture and in teaspoonful doses. It often produces slight vertigo for the first three or four days, and if this should persist the dose should be diminished, and then gradually increased to 1 grain three times daily. I have been using this remedy for the past two years, and, though it often fails, I am now and then surprised by the happy effect which seems to follow its administration.

Violent and sudden attacks of tinnitus aurium may often be helped by either bromide of sodium or of hydrobromic acid, but the use of neither of these remedies, in my experience, is attended with anything more than temporary benefit. I have rarely used the iodide of potas-

sium, though this remedy has many advocates. I have seen good, however, come from the biniodide of mercury, and this I not infrequently employ in doses of $\frac{1}{2}$ grain three times a day; and, in conclusion, it goes without saying that attention to the nasal cavities and the treatment of anomalous conditions in this location often dissipate tinnitus aurium. I have a case in mind now where a tinnitus aurium of three-years' standing was completely relieved by the removal of a large spur, and in this case there was absolutely no direct treatment of the ear instituted. The cure is one of three months' duration at the present writing.

Tympanic Vertigo. This is that variety of vertigo which is caused by either a stenosis of the Eustachian tube or by an obstruction in the latter. As a rule, tinnitus is present in this class of cases. As a result of the occlusion or narrowing within the tube the air in the tympanic cavity is rapidly absorbed, and diminished atmospheric pressure in this cavity, together with increased atmospheric pressure from without, causes the chain of ossicles to be driven inward, and thus a decided pressure is exercised upon the membranous labyrinth. Treatment, then, of these cases should be directed to the restoration of the patency of the tubes; in other words, to the breaking down of the obstructions in this region. It is perfectly evident that in these cases drugs will fail, and that applications to the throat and nares, as well as politizerization and catheterization, will meet with pretty much the same result.

Brandegee¹ has recently reported a number of cases of tympanic vertigo which were treated by Duel's method, to which I have referred in my last year's report.² It is the so-called electrolytic method. What are the points in favor of this method? The author enumerates them as follows: Ease of manipulation and a minimum amount of pain to the patient. Minimum amount of trauma to the parts involved through destruction of the stricture or occlusion. The force necessary is only that sufficient to ensure good contact for the current. The parts which come in contact with the tube can readily be rendered sterile. I have never had occasion to use this method, but from all that is said in its favor I am impressed with its value. Electrolysis is the object here, and not cauterization, and consequently a very mild current with a comparatively low voltage should be used, and in this way no damage is done to the epithelium, and the stenosis apparently melts away. Experience has taught that the method should not be employed too often in succession, and that no force should be used, as contact is all that is necessary. Brandegee reports six cases, in all of which the vertigo had

¹ Archives of Otology, vol. xxx., No. 3.

² PROGRESSIVE MEDICINE, March, 1901.

been most distressing, and all were entirely relieved by this method. McKernon, Wilson, Kenefick, and others speak of the treatment in high terms, and the entire relief obtained by some of the patients is quite remarkable.

The most recent communication on this subject is by Dr. Thomas J. Harris,¹ and is one of much interest. His experiments were conducted at the Manhattan Eye and Ear Hospital. He sought to prove, first, the value of electrolysis as compared with other methods of treatment of tinnitus due to middle-ear catarrh; second, its relative value in improving hearing; third, how permanently the stricture is relieved; fourth, what dangers, if any, lie in its use; fifth, what is the true nature of the phenomenon taking place? Thirty-three cases were selected for the treatment, and of these twenty-six had tinnitus of a chronic nature. Of these latter one was cured, thirteen were improved, and twelve were unaffected. Seventeen of the thirty-three only complained of deafness, and of these twelve were improved and five were unaffected. In other words, 55 per cent. were either cured or relieved of their tinnitus, and 72 per cent. were cured of their deafness. A very important point is how permanently the strictures are relieved. The experience of Harris is at variance with that of the originator of the method, for the former says that in many instances, after thoroughly opening the tube and passing the stricture into the tympanum, at the next electrical treatment, although the ear had been carefully inflated in the meantime, a re-forming of the obstruction was encountered. It looks as though the electric current might cause adhesion in the tube, and just such a case is mentioned in the report of Harris. In four of the cases suppuration followed the treatment—a very serious complication, and especially so as the mastoid had to be opened in one of the cases. These experiments seem to suggest, among other things, that the length of the Eustachian tube is not an invariable one—that is to say, one and a half inches—and, furthermore, that beyond one and a quarter inches the greatest care should be exercised in the introduction of the bougie.

I have dwelt upon this subject at some length because of its importance and because few of the new methods of treating these obstinate aural affections have attracted as much attention as the method of Duel. Let me give the conclusions which Harris reached: 1. The electric bougie has a place in our aural therapy, though a less important one than was at first supposed. 2. It should be used after and not before other methods of treatment. 3. It will be most apt to fail if there is any associated internal ear disease present. 4. Its results are not always permanent. The strictures may re-form, and we may hope rather for a diminution

¹ New York Medical Journal, August 3, 1901.

than for a disappearance of the tinnitus—i. e., two cases totally relieved out of twenty-five and two cases partially relieved. Its use is not without danger, and a proper knowledge of the anatomy of the part as well as of the technique is absolutely essential. It is a question whether the process is a true electrolytic one or if in many instances the obstruction is a true fibrous one.

Primary Middle-ear Sclerosis of the Young. Under this title Malherbe¹ describes an affection which finds little or no mention in the numerous text-books of otology. It is a condition which no doubt explains many of these cases of deafness in the very young, and which we are accustomed to look upon as irremediable. The principal characteristic of the disease is its early appearance and rapid progress. At first one finds in the tympanum fibrous bands which have caused more or less ankylosis of the ossicular chain. These bands are to be regarded as the remains of a mucogelatinous mass of foetal origin, and which have not been absorbed. The trouble has its origin in the middle ear and in the antrum, while the labyrinth is only secondarily involved. The tympanum retains its transparency, though it is somewhat thickened. The trouble is peculiar to the young, and is seen oftenest in girls. The deafness is usually progressive, and the rapidity of its course is sometimes astonishing. If left to itself labyrinthian involvement, according to Malherbe, is inevitable. In its early stages—that is to say, before the internal ear is implicated—the only rational treatment is to open up and clean out the mastoid, for in this way one can cut loose the bands and adhesions which have caused all the trouble, and in this way the ossicular chain may recover some of its mobility. To a certain extent the rapid progress of the disease is retarded, and the removal of a certain amount of bony tissue permits the sound-waves to reach more directly the labyrinth.

The Influence of the Radical Operation upon the Hearing. It may be remembered that in discussing the subject of the radical operation in previous reports I have stated that the operation is a very serious one, and that the danger of permanent impairment of hearing in those who before the operation could hear reasonably well is always present, and it should never be forgotten that in a number of these cases the healing process is exceedingly protracted. My views, then, as to this operation are exceedingly conservative. I should like, in this connection, to refer to a recent article by Grossmann,² who is an assistant in Lucae's clinic. He gives us a critical study of 216 cases in which the radical operation was performed. It is perfectly evident from a study

¹ Bull. Médicale, Mars, 1901.

² Archiv f. Ohrenheilkunde, Band lii., Heft 1 und 2.

of these statistics that the friends of this operation are much too optimistic about the benefit to the hearing, and the same may be said of the duration of the recovery. The best cases got well in from six to eight weeks, and it must be said that the best cases "were few in number," while the others took generally several months. The average time was three months.

The conclusions which he draws from this very interesting analysis are practically as follows: In cases where the labyrinth is intact we may hope for an improvement in 48.5 per cent. of the cases, especially in cases where the deafness before the operation was quite marked. The hearing either remained the same or gets worse in from 20 to 31 per cent. of the cases. In those cases where the functional tests before the operation would indicate a loss of some of the integrity of the internal ear the operation in the majority of cases seems to have little or no effect upon the hearing, that is to say, in about 45 per cent. of the cases; but in a few, say 38.8 per cent., there is actually an improvement. The number of cases in which the hearing was made worse was 15.3 per cent.

Condition of the Middle Ear in Congenital Fissures of the Palate.

Although we are pretty well acquainted with the close relationship which exists between diseases of the palate on the one hand, and of the ear on the other, it is not generally known that congenital fissures of the palate may give rise to disturbances in the middle ear. Lannois¹ has recently called our attention to this fact, and reports five cases in which a fissure of the palate was found to be associated with an aural affection. One might conclude from a perusal of his communication that persons affected with congenital fissures of the palate very frequently have disturbances in the hearing which may be due to a simple obstruction in the Eustachian tube, or possibly to an actual disease of the middle ear, showing itself under the garb of either a sclerotic condition or of a chronic suppurative inflammation of the middle ear. It is not unusual in these cases to find, along with the congenital anomaly of the palate, congenital malformations either of the ossicles or of the Eustachian tube, and either of these latter conditions could easily give rise to the ear trouble; but the latter, according to Lannois, is most frequently due to a chronic inflammation of the nasal fossæ and of the nasopharynx, which is almost invariably present in cases of congenital fissures of the palate, and which extends to the middle ear through the Eustachian tube.

Suprarenal Extract in Middle-ear Disease. Somers² says that the aqueous extract has a distinct field of usefulness in reducing acute

¹ Rev. heb. de Laryngologie, etc., August 17, No. 33.

² Therapeutic Gazette, December 15, 1900.

inflammatory conditions of the tympanic membrane and in all conditions of the external canal associated with the formation of granulation tissue. The solution must be combined with an antiseptic to prevent decomposition and also possible infection of the part. Eucaine and carbolic acid will often enhance the value of this solution when added to it. Five or ten drops of this solution, warmed and instilled into the ear, will often allay the pain of an earache, and this repeated may abort the trouble in its early stages, and we can use it for an anæsthetizing agent on bleeding surfaces on account of its hæmostatic properties.

Otitis Media Mucosa. This is an affection of the middle ear which has recently been described by Alderton,¹ and which has not been generally recognized by the profession. The inflammation here assumes the mucous rather than the serous type, and for this reason it is more difficult to recognize, and, unlike the serous form, it occurs relatively more frequently in adults, and it follows generally a grippal cold. An evanescent earache is not infrequent, and a very common symptom is tenderness of the parts around the auricle. Intense tinnitus is usually present, and also a sensation as though the external ear were plugged. There is no sensation of throbbing, as we see in purulent otitis media. Cracking sounds on blowing the nose or swallowing are not so frequently observed as with serous conditions, probably because of the greater degree of tubal obstruction. Mild vertiginous attacks may occur. There is neither swelling nor congestion of the osseous canal. The tympanic membrane occupies its usual position, there being neither bulging nor retraction. The lustre has gone, and the surface has a dull gray color, which latter is surrounded by a ring of congestion, and coursing across the field can be seen a number of separate capillary twigs. Beginning at the periphery and disappearing at the umbo and along the handle of the malleus, the malleal plexus is unusually prominent; but this congestion does not resemble, except remotely, that of a beginning otitis media purulenta. It is a dull and grayish-red, not brilliant and distinct, as in the latter affection. The presence of fluid cannot be made out by any difference in the various sections of the drum membrane. Functionally, the ear is apparently gravely affected. This condition of affairs may persist in various degrees from a week or two up to a matter of years, and Alderton reported a case where the condition lasted for nine years. He calls attention to the fact that change in the position of the head does not induce improvement in the hearing, as is sometimes noticeable in cases of otitis media serosa. Inflation improves hearing only temporarily, and never to the degree usually seen in the serous process.

¹ Medical News, September 21, 1901.

The treatment which has met with the greatest success in Alderton's hands consists in the incision of the tympanic membrane and the evacuation of its contents, and this measure should be repeated if necessary and always accompanied with politizerization and conscientious treatment of the nasopharyngeal condition. The mucus which will exude from the opening will be found very tenacious and difficult to remove. If the exudate persists in re-forming, a solution of nitrate of silver, one-half to one grain to the ounce of boiled distilled water, acts favorably both when injected into the Eustachian tube and when instilled into the tympanum through the incision.

Contagiousness of Acute Otitis Media. Two years ago¹ I referred to a communication by Lermoyez in this connection. This writer expressed the opinion that acute inflammation of the middle ear was contagious, and cited several cases in support of his statements. I do not think, however, that he has proved his case, for all of his patients were under the influence of a general infection—usually la grippe, and the contagiousness of this disease is, of course, generally recognized. In other words, the ear symptoms in his cases were simply those which we not infrequently see with la grippe. Very recently, Dr. Demeurisse² has approached this subject, and has treated it more exhaustively. Just as was the case with Lermoyez's patients, however, we find here that the cases were for the most part infected with influenza. The practical conclusions which one draws from a study of this report is that patients affected with acute otitis media should be isolated, and particularly children, even when the disease is primary. It goes without saying that if the child is under the influence of a general infection it should be isolated, not primarily on account of the ear, but for far more obvious reasons.

Carcinoma. The general impression prevails that carcinoma of the middle ear is very rare, and I confess to have shared in this belief; but in a very short space of time Treitel³ has collected three cases of carcinoma of the middle and external ear, and this leads me to remark that the number of similar observations has considerably increased during the past few years. The question arises whether this affection is more frequent nowadays. Treitel suggests a careful microscopical examination in all cases of polypoid granulations of the middle ear which show a tendency to recur after removal, particularly in individuals of advanced years.

Polyps. The word ear-polyp, as it is used by various authors, has somewhat different meanings. Many regard all kinds of tumors seen

¹ PROGRESSIVE MEDICINE, March, 1900.

² Zeitschrift f. Ohrenheilkunde, xviii. 3.

³ Thèse de Paris, 1901.

in the external ear as polyps, while others regard them as benign connective-tissue tumors, while still another school calls the growths granulation tumors and separates them into polyps and polypoid granulations or proliferations. Schwartze reserves the designation polyp for those connective-tissue tumors which are benign and which have a pedicle, and the surfaces of which are always covered with epithelium. Politzer speaks of a polyp as a new connective-tissue formation of inflammatory origin, with a pedicle. There are also various designations based upon the histological features.

Goerke¹ has recently given us the results of some very exhaustive examinations into the pathological anatomy of ear-polyps. He has gone most thoroughly into the histology of these tumors, and in this connection I regard his contribution as the most complete in the literature. The most important points in his work strike me as being the following: Polyps in the ear are of inflammatory origin. According to their genesis, they are either granulation tumors or myxomata, and, as a consequence, they possess the histological characteristics of granulation tissue—that is to say, of an inflammatory hyperplasia of the mucous membrane of the middle ear. We will often find new formations in these growths, and they are subject to a great variety of regressive changes, the most interesting of which is probably the so-called cholesteatomatous formation which is peculiar to aural polyps.

Bacteriology of Suppurative Otitis Media. In my last year's report² I described the bacteriology of suppurative otitis media. Very recently, Funke,³ of Philadelphia, has gone over the subject and added a great deal that is original to this chapter. He concludes that there is no specific organism of otitis media. An acute otitis media may be due to one organism, but very frequently we find a number of associated bacteria. The organisms commonly found, in the order of their frequency, are the pneumococcus, streptococcus, pyogenic staphylococci (albus and aureus), and the bacillus of Friedländer. The bacillus of diphtheria is more often present than is usually believed. The streptococcic infections are graver and last longer than pure pneumococcal infections, but both are usually supplanted sooner or later by the staphylococci. There exists a true pneumobacillary otitis, which is generally acute and which is quickly converted into a mixed infection. The gravity of the process depends exclusively upon the character of the mixed or secondary infection. All bacteriological and clinical data indicate that otitic inflammations present different bacteriological findings in different localities.

¹ Archiv f. Ohrenheilkunde, Band lii., Heft 1 und 2.

² PROGRESSIVE MEDICINE, March, 1901.

³ American Medicine, November 9 and 16, 1901.

THE INTERNAL EAR.

Rheumatic Affections of the Auditory Apparatus. So far as I know, the rheumatic affections of the auditory nerve and its branches have been little studied. Few communications on this subject will be found in otological literature. This is probably due to the fact, as Hammerschlag¹ has pointed out, namely, that these conditions are not so easily interpreted, because they present a rather complex train of symptoms, and that it is not always easy to establish the fact of a rheumatic basis. Cases of this character have been reported by Kaufmann,² and recently Hammerschlag has added to the literature of the subject by reporting several cases, and, at the same time, he gives us a critical analysis of cases reported by others. Fourteen cases are reported in all. It is evident that rheumatism played a very important rôle in all these cases. "Catching cold" is a fruitful source of such a trouble, and a number of times the trouble showed itself where the patient, while perspiring profusely, was exposed to a draught. It would seem that the rheumatic affections of the auditory apparatus are more apt to be seen in middle life and more frequently in men. As regards the symptomatology we must distinguish between cases where the auditory apparatus alone is affected and those where the involvement of the auditory apparatus is simply one of several symptoms. Among the fourteen cases the auditory nerve by itself was affected in only six cases. It is interesting to give in detail the usual symptoms, for we find practically little reference to them in the text-books. An individual with normal hearing will suddenly be attacked with tinnitus and giddiness, and will also have a decided rise of temperature. The hearing is markedly affected. The tuning-fork tests show a primary affection of the auditory apparatus; that is to say, when the fork is placed on the skull it will be either heard in space or sometimes will be located in the direction of the better ear. Rinne's test is positive on the affected side, and the bony conduction on this side is sometimes abbreviated and is completely abolished for the watch. The tinnitus is not continuous and the otoscopic examination is negative. Giddiness is apt to be present, and the attempt to walk with the eyes closed or to stand on one leg is usually followed promptly by disturbances in co-ordination. At the commencement of the trouble giddiness is a very conspicuous symptom.

It must be confessed, however, that all the symptoms just enumerated may be found in any acute labyrinthian trouble; in other words, there

¹ *Archiv f. Ohrenheilkunde*, Band lii., Heft 1 und 2.

² *Zeitschrift f. Ohrenheilkunde*, 1897.

is little about these symptoms to stamp the trouble as one of rheumatic origin. And in these cases there is no doubt the same difficulty in arriving at the etiology as there sometimes is when we are debating whether we are dealing either with a rheumatic or a syphilitic iritis. The previous history of the patient is a great help in reaching a proper diagnosis. According to Hammerschlag, the coincident involvement of other cerebral nerves, as, for instance, the facial, would be evidence in favor of the rheumatic origin of the trouble. The same observer has noticed that the clinical course in cases where only the cochlear portion of the auditory nerve is involved is different from that in which both the cochlear and vestibular branches participate. In the latter condition the symptoms which have their origin in the vestibular branch are apt to get well very rapidly, while the diminution of hearing due to involvement of the cochlear portion gets well very slowly, if at all; from which we may conclude that the gradual amelioration of symptoms which point to trouble in the semi-circular canals would not justify us in concluding that our patient was going to make a complete recovery. It is clear, from what we all know in general of the behavior of internal ear troubles, that great caution should be used in giving a prognosis in cases such as Hammerschlag has described. We can promise pretty certainly a disappearance of the disturbances of co-ordination and of the giddiness and nausea, but we can say nothing certain with regard to the hearing. From a study of Hammerschlag's cases we might separate the rheumatic affections of the auditory apparatus into two groups. The first group comprises those cases where the injury to the hearing is irreparable, and the second group comprises a set of cases where recovery is complete. Hammerschlag gives no good reason for the different degrees of intensity in these two groups; why, in other words, recovery takes place in one case and deafness results in another.

The Mastoid. Nowadays, when otological literature is so full of reports on mastoid operations coming in from every quarter, it is somewhat refreshing to light upon a communication embodying the experience of one who has done so much in this line of work. I refer to Zaufal, of Prague. His assistant, Dr. Otto Piffi, analyzed seventy-five cases of mastoid operation in association with acute suppurative otitis media.

Let me enumerate the symptoms which call for the mastoid operation—symptoms with which the reader is no doubt familiar, but which will bear repetition when we are reminded of them by such an authority: Middle-ear suppuration, fever, violent pain, infiltration, or abscess formation in the vicinity of the ear, gravitation of pus into the bony part of the external auditory canal, headache, giddiness,

nausea, and ophthalmoscopic changes. When these symptoms persist in spite of the usual measures for their relief, opening of the mastoid is demanded. Of course, these indications hold good, even when there is no longer any active discharge, the latter having ceased. An indication for the operation, and one which is less often met with, is where there is one-sided deafness, and where the hearing ear is the seat of a discharge which has begun to destroy the hearing on that side. It is interesting to note the ophthalmoscopic changes which were found in a number of cases—venous hyperæmia, dilatation and tortuosity of the vessels, haziness of the disk outlines, and once a well-marked optic neuritis. In nine of the twelve cases in which eye changes were found the operation revealed the fact that the brain was involved. The importance, then, of an ophthalmoscopical examination in these cases is evident. In only one case were the eye changes unassociated with intracranial changes, and I am of the opinion that when we find neuritis or distinct vascular changes in the retina in a case of suspected mastoid involvement the process should be opened at once unless there be something else which might reasonably account for the ophthalmoscopic changes.

Another point which is of interest as showing the unsatisfactory results which often follow Wilde's incision in this class of cases: Of twenty-two cases which were subjected to the Wilde incision only three were permanently relieved—a fact which quite sustains the position which I took last year, namely, that the prospects for recovery after the Wilde incision are slight, and that even in those cases where recovery results it is usually a tedious one. According to Piffi's statistics, it would seem, too, that the chances for restoration of hearing were not so good as after a regularly performed mastoid operation. Schwartze¹ has made the statement that in acute otitis media suppurativa there is no one symptom which by itself affords an indication for opening the mastoid. With this statement I agree entirely. As regards the length of time which an acute process must be allowed to run before an operation is indicated, I am disposed to follow pretty much the same road as I pointed out in my last year's report; that is to say, a more or less conservative course. Unless there is mastoid sensitiveness, or persistent earache, with fever and otorrhœa, I doubt the necessity of opening the mastoid. I certainly cannot agree with Gradenigo,² who puts the limit of delay at twenty days; still less with Müller,³ who says that every acute inflammation of the middle ear which resists the usual treatment for over fourteen days should be subjected to the mastoid operation

¹ Handbuch f. Ohrenheilkunde, Band 2.

² Archivio italiano di Otologia, etc., viii. 1-3.

³ Charité Annalen, xxii., Jahrg.

even where there are no grave symptoms present. We all know that suppuration alone can be kept up by diseased conditions of the post-nasal region by a lowered condition of the whole body, and unless these factors can be certainly eliminated one should not think of opening the mastoid in the limit of time laid down by Müller.

With respect, then, to the simple question of time, we can lay down no rule. I recall at least four cases which I saw during the past winter, and which recovered with unimpaired hearing, and all four ran several weeks beyond the time-limit of either Müller or Gradenigo, and I am convinced that such occurrences are frequent. I see no special reason for giving a time-limit, but if I had to do so I should say that the mastoid should be opened if, after thirty days, the discharge were profuse, even when earache, fever, and mastoid sensitiveness were absent; that is to say, if no reasonable cause could be found to account for the persistence of the discharge. I would caution, however, against the tendency to be guided by a high temperature. I have seen a number of cases of acute suppuration of the middle ear following la grippe, and exceptionally have I seen the temperature reach 103° F. (in the cases in which I opened the mastoid). The temperature in my cases has usually ranged from 99.5° F. to 100.5° F., and if I remember aright in none of the cases upon which I operated during the past three years has the temperature gone over 102° F., and few have reached that point, and this has been my experience even in young people in whom we would be apt to expect a higher temperature.

MASTOIDITIS WITHOUT INFLAMMATION OF THE EAR. In my last year's report¹ I referred to a case of mastoiditis in which there were no objective symptoms of middle-ear trouble. I mentioned also a somewhat similar case which was observed by F. F. White. Both these cases were instances of mastoid trouble unassociated at the time of operation with any ear trouble, so far as could be seen, but in both cases there had been a history of ear trouble a short time previously. Lenhardt,² of Havre, reports a case where there was mastoiditis with practically no ear symptoms. A similar condition has been observed, I think, by Lubet-Barbon. It is puzzling, to say the least, as to what is the etiology of cases like these. Luc is of the opinion that some general condition is at the bottom of it, as, for instance, a rheumatoid osteitis; and in this connection I should refer to a case recently observed by Thompson.³ The patient was being treated for what was supposed to be typhoid fever. During the night she complained of great pain in the ear, and this pain extended over the mastoid

¹ PROGRESSIVE MEDICINE, March, 1901, pp. 423-425.

² Rev. heb. de Laryngologie, etc., July 13, 1901, No. 23.

³ Medical Age, May 10, 1901, p. 356.

region. There was some swelling over the mastoid, but the interesting point here was the condition of the drum membrane, which was perfectly healthy. Notwithstanding this, a paracentesis of the drum membrane was made, and a small quantity of pus oozed out. Later on it was thought necessary to open the mastoid, which was found to contain granulation tissue. It is further interesting to note that all the painful symptoms disappeared after the paracentesis of the drum membrane, in spite of the fact that very destructive changes were discovered in the mastoid. I have dwelt upon this subject quite fully to show that it is not such a rare thing, after all, to meet with mastoid disease without any apparent involvement of the middle ear. Physicians, then, who meet with patients complaining of great mastoid sensitiveness should not be misled as to the true nature of the trouble because the drum membrane looks normal. Mastoiditis is nearly always accompanied with a temperature; and if I found this latter condition, with marked tenderness, I should not hesitate to operate, even in the absence of objective middle-ear symptoms, for these are the cases which have shown profound mastoid involvement.

UNUSUAL ANATOMICAL CONDITIONS SOMETIMES MET WITH IN MASTOID OPERATIONS. It may be of interest to note the fact that in the operation for mastoiditis we sometimes meet with unusual anatomical conditions. For instance, Citelli¹ describes very minutely a special cell which he discovered in a man, aged sixty years, whose mastoid was opened. After the cortex was removed a very large, cylindrical-shaped cavity was discovered, which at first sight looked like the antrum; but more careful examination showed it to be an enormous mastoid cell situated a little further back and more superficially than the antrum. The cavity of this cell had a width of twelve millimetres, a height of five millimetres, and a depth of six millimetres. It is evident that this cell can be a source of danger in chronic mastoiditis, when we consider that it stands in close relationship above with the middle cerebral fossa, and below with the lateral sinus. When one sees, after the operation for chronic mastoiditis, the symptoms either persisting or disappearing very slowly, an explanation might possibly be found in the presence of this cell.

TREATMENT OF ACUTE MASTOIDITIS WITHOUT OPERATION. In these days of mastoid operations, to treat a case of mastoiditis without operation seems like taking a step backward and returning to the days of our forefathers; but every year brings me cases which get well with less radical measures than operation, and I think that this is the experience of all aurists. I agree with Bacon in commending the Leiter

¹ Archiv ital. di otol., 1901, xi. 3.

coil in the first or hyperæmic stage of the disease, and since the prompt and systematic use in every case of either this arrangement or the ice-bag I have seen fewer cases of mastoiditis demand operation. In the pus-forming stage cold applications should be abandoned, as they undoubtedly mask pain and lead one to think that the condition is on the mend. Bacon reports forty cases of mastoiditis, and in only ten of these was an operation found necessary. The same author speaks strongly against the use of opiates, phenacetine, and quinine in these cases. I have always regarded quinine as the deadly enemy of an ear which is the seat of a purulent inflammation. In such a condition, even with a high temperature, bloodletting is better than quinine. In the beginning, when the tympanic cavity alone is involved, the leech should be applied in front of the tragus, and if the mastoid process has become sensitive the blood should be extracted from behind the auricle either at the site of the antrum or over the tip of the process. The Leiter apparatus should not be allowed to remain on over forty-eight hours. In cases of scarlet fever, measles, diphtheria, and influenza, and especially when we have a streptococcus infection, Bacon advises early paracentesis of the drum membrane, even though bulging of the latter may be absent. I can only say, in conclusion, that it is refreshing to hear such an authority express himself so conservatively on the treatment of mastoiditis; for one would suppose, from a survey of a great deal of the literature of the present day, that a pain behind the ear calls for opening the mastoid. I should always insist that this class of patients go to bed and stay there until pain and fever have been absent for at least three days. This point has been referred to in a paper by C. W. Richardson,¹ of Washington, and cannot be too strongly emphasized. I have again and again had patients come to my office with a tender mastoid and a temperature of 102° F. who think it a great imposition to have to go to bed.

OPENING THE MASTOID IN THE PRESENCE OF A CONSTITUTIONAL DISEASE. It seems to be generally acknowledged that in only exceptional cases does the presence of a grave disease constitute a contraindication to the mastoid operation. According to Friederich, the greatest danger from operation on a diabetic lies in the narcosis. It is to be hoped that some day we will be able to bring local anæsthesia to bear successfully upon this class of cases. A number of cases of diabetic mastoiditis have been reported as successfully operated upon. Recently a very interesting and instructive case is described by Barth,² where the patient, a diabetic, had a chronic mastoiditis of four months' standing before the mastoid operation was undertaken. It was perfectly successful.

¹ Laryngoscope, July, 1901.

² Zeitschrift f. Ohrenheilkunde, 1901, xxxvii. 4.

This case goes to show that a diabetic who has 2.5 per cent. of sugar in the urine can be operated upon with impunity. The same author reports cases operated upon who were gouty and tuberculous. He evidently does not think that either of these diseases is a reason for withholding from such a step as the mastoid operation. The last case (a tuberculous man) was particularly interesting. There was first a tuberculous otorrhœa, which the author did not at first consider as consecutive to the pulmonary tuberculosis and due to an infection through the tube, because the ear trouble made its appearance a little before the pulmonary symptoms manifested themselves, and the pulmonary trouble was accompanied by neither cough nor expectoration; and, finally, the simple fact that the ear remained completely cured, which would not have been the case had the patient been the subject of advanced tuberculosis.

CONSERVATISM IN OPENING THE MASTOID. In speaking of the question of conservatism in opening the mastoid, Dench¹ seems to think that errors are too often made on the side of conservatism; and in referring to his cases, which were operated upon early, he states that in no instance has he opened the mastoid process without finding considerable destruction of the osseous tissue, and it has never been his experience to find a mastoid in such a condition as to have warranted delay in operating.

HYSTERICAL MASTOID PAIN. Three years ago² I referred to this class of patients, and stated that Sattler had adopted the plan of opening the mastoid for this kind of pain; recently Lannois and Chevanne³ have made an important contribution on this subject. Several years ago Gradenigo made an important communication on this subject. It was he who called attention to the fact that subjective ear symptoms are greatly aggravated by the so-called hysterical neurosis, and, finally, Chevanne made plain the close connection between the ear and hysteria. Just like all other parts of the ear, the mastoid can be the seat of hyperæsthetic zones of special character. These zones usually give rise to hysterical symptoms when subjected to pressure, though cases have been observed where the symptoms manifested themselves spontaneously. It is more often seen in women, and is usually met with in individuals who have had some ear trouble. Even a blow over the mastoid may determine an outbreak. According to Lannois, mastoid pain without any previous history of either ear trouble or injury to the bone is extremely rare. At the time of the attack we may find what is apparently a perfectly sound ear, and then, again, we may find an ear which

¹ Medical News, July 6, 1901.

² PROGRESSIVE MEDICINE, March, 1899, p. 459.

³ Annales des Maladies de l'Oreille et du Larynx, etc., July, 1901, No. 7.

is the seat of more or less disease, even of suppuration ; but, above all, stands out the intensity of the mastoid pain. This pain does not make its appearance suddenly, but gradually, radiating all over that side of the neck and head and becoming more intense in the immediate mastoid region. Pain is very intense on the slightest pressure ; in fact, even to the touch the skin over the mastoid elicits expressions of suffering. We may have some superficial redness of the skin over the mastoid. The general condition participates, of course, and we can arrive at a stage of cachexia. Sometimes cerebral symptoms appear to perplex the physician, and we can even have fever and delirium, and doubt will often arise as to whether we are not dealing with a latent mastoiditis. An examination of the external auditory canal will reveal either nothing pathological or something insignificant, and which certainly plays no part in causing the pain. A thorough examination of the nervous system will often show the hysterical stigmata, which would furnish an explanation for this intense and persistent pain unaccompanied with objective symptoms. These two points would be sufficient to differentiate the affection from a true mastoiditis. Another peculiarity of this affection is the fact that simply touching the skin over the mastoid is often as intensely painful as actual pressure upon the bone itself, and, finally, the characteristic manner in which the trouble showed itself. These points, I say, would go a long way toward eliminating the existence of a true mastoiditis. But it is evident that most opinions on this subject go to show the great similarity between the two conditions, and this makes it all the more important that an exhaustive examination of the nervous system be made. Those who have written on this subject do not regard the prognosis as always good, for there is a great tendency to a return of the paroxysms of pain. Strange to say, a well-directed suggestion often makes us masters of this situation, as it sometimes does of other distressing nervous phenomena. In several of the cases reported by Lannois and Chevanne opening of the mastoid was practised and a cure resulted, and it is needless for me to say that a perfectly sound mastoid was found.

OTOGENOUS PYÆMIA.

In spite of the additions to our knowledge on this subject we are far from united as to the pathology of pyæmia due to ear disease. It seems very doubtful whether extradural abscesses can cause pyæmic metastasis, and it has been a long-contested point as to whether septic material can be taken up into the general circulation direct from the middle-ear cavities. Pyæmia, according to Jansen, is always associated

with phlebitis of the sinus—that is to say, if the pyæmic symptoms persist after the termination of the first stage of an acute otitis media. The same author¹ acknowledges that mild pyæmic symptoms can arise from a mastoiditis, but he seems skeptical about both its practical importance and its frequency, and he is opposed to the idea that a mastoiditis can give rise to metastases. It is interesting, too, to observe that Jansen has collected from the literature 60 cases of pyæmia without thrombosis of the sinus, and of these 16 got well without operation. This is certainly remarkable, and we may be pardoned for a little skepticism as to the correctness of the diagnosis. There is in many of these reports a want of thoroughness, and sufficient reason for operative steps is not given. For example, in 25 cases which were operated upon we find 15 which have no clinical histories, and with little if any discussion of the existing conditions and special reasons for operating. In six of these cases the bone (mastoid) was found sclerosed and normal. In 63 cases of pyæmia which were operated upon by Jansen 4 cases showed neither sinus nor bulbous thrombosis. As regards the treatment of this class of cases, there seems to be unanimity in the opinion that a septic thrombus should be removed. There still seems to be disagreement over the question of the ligation of the jugular. A mild pyæmia will get well with simply a free exposure of the sinus, and judging from recorded cases this latter step, together with ligation of the jugular, gives better results than when the jugular ligation is omitted. For example, among 94 cases there were 40 where the jugular was tied, while in 54 cases the operator omitted the ligation. Of the 40 cases 6 died and 34 recovered; and of the 54 cases in which there was no ligation of the jugular, 13 died and 41 recovered, but of these 41, 16 had fever for a long time, and 11 had metastases.

Zaufal, Körner, and von Bergmann have ranged themselves on the side of the friends of ligation of the jugular, while Brieger, Hessler, Leutert, and Macewen are much less disposed to make this a routine step. Jansen is of the opinion that in all pronounced pyæmias where the general condition is bad, and especially where there are pulmonary metastases, that the operation should be associated with the ligation of the jugular, and he also ties the jugular where, after exposing the sinus, he finds at the point a sanious fluid and the assumption existed that the infection has extended to the bulb. Where there is a solid thrombus in the sinus ligation seems needless. Jansen lays down the rule that a sinus should only be opened when a septic thrombus is present, and never for diagnostic purposes, and for the latter purpose we may substitute the needle. Jansen's statistics are exceedingly valuable, and

¹ Archiv f. Ohrenheilkunde, Band lli., Heft 3 und 4.

comprise 50 cases, and of these in only 20 was the jugular tied. His statistics, briefly stated, are as follows: Where the sinus alone was operated upon he obtained cures in 100 per cent., while in those cases where the ligation of the jugular was undertaken he obtained cures in 75 per cent. His percentage of recoveries in all cases operated upon was 86.4 per cent.

It is interesting, too, to refer to the bacteriology of this form of pyæmia. Most often we have streptococci, staphylococci, pneumococci, and the bacillus of Friedländer. All these have been shown to have caused sinus thrombosis. The virulence of the organisms is variable, and does not always correspond to the intensity of the symptoms. The bacteria are not found uniformly distributed throughout the thrombus. Just in proportion to the quantity and virulence of the organisms throughout the different areas do we have in one instance a simple infarct or the formation of a metastatic abscess. Brieger thinks that if the patient survives one attack of pyæmia he does not secure immunity from further attacks, and the same author holds that the temperature alone cannot be the crucial symptom by which we should be guided, for we know that even in uncomplicated suppurative processes the temperature shows high febrile movements. The characteristic curve alone is convincing, although this curve can show variations, and in sinus thrombosis fever may be entirely absent. In this connection Leutert¹ holds that, allowing for the disappearance of the initial stage, a temperature of 39° C. makes sinus thrombosis probable. Brieger thinks that diabetes is probably the only condition which should make us hesitate to operate, although he reminds us that operative measures have been successful in even such desperate conditions as meningitis and metastatic lung abscesses. What we want to get in these cases is the closure of the sinus in both directions, and hence Brieger advises against cleaning out of the solid thrombus masses at the ends of the thrombus. Where the sinus is not completely closed there is some danger, on opening it, of allowing the air to enter. The air, of course, could only get into the venous circulation by way of the jugular, and we can prevent this complication by either compression or by ligation of the jugular; and the same measure will prevent the distribution of small, detached masses of the thrombus, but it should be remembered that this step is not free from danger, for thereby we may allow the thrombus to extend and occupy a portion of the vessel which has remained free. Ligation seems to be a sure safeguard against the further extension of the phlebitis in the continuity of the vein. The danger of the ligation is, of course, much lessened when the ligated section is split open.

¹ Archiv f. Ohrenheilkunde, Band lii., Heft 3 und 4.

According to Schimmelbusch and others, thromboses do not owe their existence to injuries, but to a chemical blood infection. Jansen believes that the sinus should be incised as soon as possible, and he holds that this procedure is absolutely free of danger. The same author has changed his platform, and believes now in ligation, which should be the first step in the operation; and he calls attention to the fact that while there may be in ligation a theoretical danger of the thrombus passing over to the petrosal sinus, there is certainly no vindication in fact for this possibility. Brieger is one of those who does not believe in the exploratory puncturing of the sinus. I have dwelt upon this subject at considerable length, owing to the great importance which surrounds it nowadays. In these days of influenza otitic pyæmia is not such a rare occurrence, and the foregoing represents the latest and best views on the subject.

INSPECTING THE HEARING.

As a general rule, one never recognizes that one's hearing is becoming a little less acute until too late to get much good from treatment. Lermoyez¹ has made some interesting observations on this point. He starts out with instructions to be followed in earliest childhood. If an infant of six months appears to be indifferent to the various everyday sounds around it, and if later, at the commencement of the second year, it does not speak, the parents would be justified in concluding that the child's ears were affected, and an aurist should be consulted at once. In the case of a child this inspection should be most rigid, for its mental development depends so much upon its hearing. Lermoyez thinks that many of the children in the schools who are accused of being hard-headed are really hard of hearing; therefore when the child has reached its seventh year it should again be subjected to a careful examination. A dictation test which has been devised by Gellé is the simplest and most rapid one, for with it we can estimate the auditive acuity of the children and single out those who are really deficient in this respect, instead of sending them to the bottom of the class, as is so often done in the large public schools. Later on in life, when a vocation must be chosen, Lermoyez advises first a consultation with an aurist. If there is an old perforation, he should avoid the maritime profession; if there is a family history of ear deafness, let him beware of a calling which takes him into noisy surroundings or into big cities. Advise him not to marry. In conclusion, he advises that even in adult life the hearing should be tested from time to time, and I am persuaded that this is

¹ Rev. heb. de Laryngologie., etc., Juillet 20, 1901, No. 20.

wise advice, for good hearing is of the utmost importance in certain occupations, as, for instance, in engineers.

LOCAL ANÆSTHESIA.

Both last year and the year before I alluded to the question of local anæsthesia in the ear. We all know that it is by no means easy to get such anæsthesia in the ear as will allow us to make a painless incision in the drum membrane. It will be remembered that last year¹ I referred to the work of Albert Gray, of Glasgow. This observer found that he obtained most satisfactory anæsthesia with a mixture of five parts of cocaine, fifty parts of aniline oil, and fifty parts of alcohol. I have been trying this mixture during the past year, and I have found that it is extremely satisfactory. During the winter, when ear complications are so frequent in la grippe, the necessity for a liberal incision in the drum membrane often arises, and in every instance I have used this mixture. Cocaine upon the unbroken drum membrane leaves much to be desired as an anæsthetic, and when that membrane is swollen and congested the absorption amounts to very little, and it is just in these cases that Gray's mixture proves valuable. I have never made any experiments to prove the point, but I should think that a mixture containing such ingredients ought to be aseptic—something we cannot say for a cocaine solution unless it has been boiled.

Very recently Dupuy and others, of New Orleans, have been making experiments with this solution, and have put on record fifty cases of acute inflammation of the middle ear in which tympanotomy was performed. In thirty cases the anæsthesia appeared to be complete. Failing in two cases to get satisfactory anæsthesia, fifteen parts of cocaine were used (instead of five parts), and the anæsthesia was perfect. Subsequent experiments showed that the best and most uniform results were obtained when the cocaine was increased to twenty parts, and with this mixture the ossiclectomy was performed painlessly.

Dupuy² reports a case where toxic symptoms followed the use of this solution. The agent had been used in persistent earache, and with success, as the pain was completely relieved. The patient, however, was noticed somewhat later to have become very drowsy. The lips and nails were bluish-black, the face ashy in hue, and the skin cold and clammy. The entire surface of the body was bathed in sweat, and the temperature was 97.3° F., pupils normal, pulse 136, and respirations 36. The dark blue color which tinged the patient's face and hands

¹ *PROGRESSIVE MEDICINE*, March, 1900, p. 429.

² *Laryngoscope*, October, 1901.

was very noticeable. The patient was revived by washing out the ear, the administration of atropine ($\frac{1}{100}$ grain) and strychnine sulphate ($\frac{1}{30}$ grain) every two hours, and 10 drops of aromatic spirits of ammonia every hour. The peculiar cyanosis of the lips and finger-nails persisted for twenty-four hours.

A review of the literature of aniline would seem to show that it has been generally regarded by chemists as non-toxic, but since its general adoption as a coloring agent it has been shown to be very poisonous, and cases have been recorded where its toxic powers were experienced by inhalation and even by cutaneous absorption. The peculiar dark blue color of the cyanosis around the lips and under the finger-nails are characteristic of aniline poisoning. Gray noticed in several of his patients a blueness of the lips, which disappeared without untoward symptoms. He holds that the cyanotic tinge is due to the transformation of the oxyhæmoglobin into methæmoglobin, and that it always passes away in a few hours without ill effects. I have repeatedly employed this agent during the past two years in operating upon the tympanic membrane, and I have never noticed the cyanosis. The solution was never used except for operative anæsthesia, and was instilled into the external ear and usually allowed to remain for twenty minutes, after which time I have succeeded in getting most satisfactory anæsthesia for operative purposes. In the light of Dupuy's report and of somewhat similar observations by Gray,¹ and also one by St. Clair Thomson,² we should never entrust this solution to the patient to use for alleviating pain, and I am of the opinion that it should never be used except for operative purposes, and when the operation is completed the external canal should be well irrigated.

THE SENILE EAR.

We all know how frequently we are consulted by old persons who complain of dulness of hearing, and in whom we are often unable to find anything which explains the trouble. It is sufficient to say that many have endeavored to explain the dulness of hearing peculiar to advanced years, but so far as I know no exhaustive study of this subject has been made. Dupoutre³ has shown considerable ingenuity in his investigations in this connection. Without going into the details of his work I might briefly state that in the external auditory canal he found that plugs of cerumen often in a measure accounted for deafness. Marked hypertrophy of the bone of the tympanic groove and relaxation

¹ Lancet, March, 1901.

² Lancet, April, 1901.

³ Thèse de doctorat, 1901.

of the tissues all along the canal were often found. When we come to the tympanum either localized or diffuse opacities were found, and sometimes calcareous plaques. In about half the cases there was considerable diminution of the mobility of the ossicles. The most frequent and most serious complication was ankylosis of the stapes in the oval window, and various other adhesive processes were seen, such as membranous synechiæ, which were found all the way up into the antrum. The size of the antrum, without differing very materially from what we see in younger individuals, shows a tendency to shrinkage. The mastoid region is characterized by two clearly defined sets of changes. First, the apophysis may be eburnated, and then we may have a so-called pneumatic condition of the mastoid process. The cells in the tip may be very much larger than usual. There may be excessive thickness of the cells of the external cortex. Sometimes we may find extreme thinness of the cortex of the tip at the border of the digastric groove.

The most important conclusions which may be drawn from Dupoutre's work are that senile deafness is generally due primarily to middle-ear trouble, and consequently therapeutic measures can only be valuable in certain cases. The osseous condensation which is present in the antrum and its surroundings makes chronic suppuration of the middle ear less to be feared than in young people. In acute suppuration of the middle ear Bezold's mastoiditis is more to be feared, and this is to be attributed to the propagation of the suppurative process to the posterior cells.

PERFORATION OF THE TYMPANUM AS A MEANS OF DIAGNOSIS AND OF PROGNOSIS IN CERTAIN CASES OF DEAFNESS.

Those forms of deafness which come on in an insidious manner, without either local or general cause, are too often set down as sclerosis of the middle and inner ear, when many of these cases are nothing more than middle-ear catarrhs, or probably tubal catarrhs which are capable of improvement. I agree with Brunel in thinking that too much importance is attached to the existence or absence of osseous perception in this class of cases. In a great many cases of middle-ear sclerosis osseous perception has entirely disappeared, and one would be disposed, in consequence, to give a very grave prognosis. Brunel¹ suggests that in these puzzling cases if we can do something to make aerial perception better the osseous perception frequently returns and sometimes becomes excellent, which turn of events clearly shows that we have not such a

¹ Rev. heb. de Laryngologie, etc., October 26, 1901.

hopeless condition of affairs as was first indicated, but simply a middle-ear sclerosis, with paresis of the auditory nerve, owing to a want of functional activity. The procedure which Brunel has suggested in order to give us an exact diagnosis is an exploratory incision of the tympanic membrane. Brunel states that the following results may ensue from this perforation: In a certain class of cases the hearing is diminished, and according to Brunel we can say here, without any hesitation, that not only the middle ear but also the labyrinth is affected. It is no longer a question of adhesions or ankyloses which prevent the non-transmission of the sound, but we are dealing with a sclerotic condition which involves also the internal ear. After the incision the sound-waves no longer reach or strike the edge of the stapes, and to the sclerosis, which is one cause of the deafness, we have added another—flaccidity of the membrane—and this is shown in the diminished acuteness of hearing.

In another set of cases the hearing seems to be uninfluenced by the operation, and this result would indicate that the internal ear is not involved, and Brunel concludes that the obstruction to the hearing is situated at the edge of the stapes, which is probably rendered immobile by fibrinous adhesions. This can be verified by exercising alternately slight traction and then pressure upon the ossicular chain by means of a delicate hook, which is passed behind the handle of the malleus. The movements of the foot-plate of the stapes produce more or less vertigo and sometimes syncope. If there is ankylosis of the stapes there will, of course, be absence of these symptoms.

Finally, there is a class of cases in which hearing is more or less ameliorated by the incision in the drum membrane. Such a result is seen when there is simply a thickening of the drum membrane with, perhaps, a few adhesions. In this case the sound-waves strike directly upon the mobile stapes, and better hearing results. In this way one can locate exactly the point of the adhesions; in other words, in what part of the ossicular chain the trouble lies. The value of this measure, then, lies in the fact that by it we are enabled to differentiate between simply a middle-ear sclerosis and an involvement of the internal ear. I am sure we all have cases now and then where the usual tests fail to give us precise information, for, as I have said, in cases of long-standing sclerosis of the middle ear osseous perception is lost.

DIPHTHERIA AND MIDDLE-EAR DISEASE.

It has been generally thought that scarlet fever attacks the ear more often than any of the other diseases, but Heydloff, Burkhardt-Merian, and others hold that diphtheria comes in for quite as large a

share in causing middle-ear trouble. It is evident, however, from a survey of the literature that authors have disagreed as to the relatively exact part played by each of these diseases in the production of suppurative inflammation of the middle ear. Very recently Lewin¹ has taken up the question and presented us with a communication embodying an enormous amount of work performed in the clinic of Professor Habermann.

The first part of the work contains his observations upon the clinical aspect of the question, while the second part is devoted to a consideration of the anatomical changes found in a few cases. What particularly concerns us is the clinical part of the work. All of the cases which were examined—and there were sixty in all—had genuine diphtheria of the fauces and nasopharyngeal region. I need not go into a detailed review of Lewin's findings, but will simply refer to his conclusions. He seems to think that participation on the part of the ear in pure diphtheria is a very common occurrence, it having been found in 63.3 per cent. of his cases. Generally speaking, the age is to be borne in mind, for most of the cases with ear complications were in children of five years and under (84 per cent. of all positive cases), and from the fifth year down the number of ear cases diminished—that is to say, 13 per cent. of all positive cases between the sixth and tenth year, 3 per cent. between the eleventh and fifteenth years, and 0 per cent. over fifteen years.

The ear trouble in genuine diphtheria appears and runs its course, as a rule, without subjective symptoms, and even the objective symptoms in by far the majority of cases are exceedingly mild and take the form of a simple exudative inflammation of the middle ear. Rarely do we meet with a genuine acute otitis media, while spontaneous perforation of the tympanic membrane is seldom met with. The objective symptoms generally appear early, either coincident with or even somewhat before the local process in the throat. In the pathologico-anatomical sense the specific diphtheritic inflammation of the middle ear is seldom seen as an accompaniment of genuine faucial diphtheria.

It shows itself by the intensity of the symptoms and course, and, by causing a general infection, may result in sudden death. On the other hand (and this is not generally known), diphtheritic inflammation of the external ear in genuine diphtheria is not such a rare occurrence even when the middle ear is absolutely intact. This may be due to the actual contact of the diphtheritic virus with the tender epidermis of the child's auricle.

¹ Archiv f. Ohrenheilkunde, Band lii. und liii., Heft 3 und 4.

THE EAR AND HYSTERIA.

In speaking of the so-called mastoid hysteria I am reminded of a recent communication by M. Chevanne.¹ It is probably the most exhaustive work extant on this interesting subject of the connection between hysteria and the auditory apparatus. He shows that the connection is a much more frequent one than we have supposed. We have first a historical survey of the subject, and then a detailed study of the various methods of functional and objective examination of the ear. The historical and critical part of the work is admirable. Chevanne has adopted certain methods for the functional examination of the ears of hysterics which he finds has given pretty constant results. These are the aerial conduction for the watch, the whisper, the method of Weber, of Rinne, Bing, and Corrodi. In the case of each of his subjects there is carefully recorded the cranio-tympanic and aerial perception of a uniform and constant series of tuning-forks. He compares the results obtained with those obtained in the case of normal subjects, and expresses the whole in hundredths, and gives us a very suggestive diagram. He speaks of two big divisions of this class of subjects—one class embraces those whose nervous symptoms should be examined just as we examine the field of vision, and it is the study of these cases which permits us to establish the existence of an otitic syndrome of hysteria. The other class is composed of those where the auricular symptom is the manifestation which dominates all the other hysterical symptoms which may be present. He describes in detail the various subdivisions of the subject, and he has given us, as I have said, a veritable monument in the way of information.

DEAF-MUTISM.

I have more than once spoken of deaf-mutism in these reports, and I have given considerable space to a discussion of the various methods of treating these unfortunates. I have referred particularly to the work of Urbantschitsch, of Vienna, and to the fact that his method has gained ground, though it is still on trial. I cannot urge, however, too strongly upon the general practitioner the importance of subjecting very young deaf-mutes to an early examination at the hands of an expert, with the special view of finding out whether there are any pathological conditions in the throat which may be responsible for the ear trouble. Deaf-mutes at any age should be regarded as fit subjects for

¹ Oreille et Hystérie; Thèse de Lyon, April 20, 1901.

treatment, and that, too, with hope of more or less amelioration of their condition.

It is interesting in this connection to learn something of the upper air-passages in these people, and there is no better way of getting this knowledge than by a systematic examination of the inmates of a large asylum. This has recently been done by Dr. A. Jousset,¹ of Lille. We all know what peculiar voices deaf-mutes have, and these investigations may suggest some explanation for this peculiar pitch and tone. The examination of the larynx showed at first sight scarcely any difference from what we will find in the normal-hearing individual, except that the tissues seemed somewhat puffy. The epiglottis was quite voluminous and, in the case of young individuals, was apparently surrounded with a sort of tonsil developed at the sides of the tongue. The epiglottis and arytenoid appeared to lift up the larynx and to form a funnel beneath the vocal cords. In a group of eighty-three deaf-mutes, from eight to eighteen years of age, only twenty were found who had free, open larynxes. In a certain number of cases, generally in young individuals, there was noticed a very marked elongation of the larynx from before backward. The organ seemed contracted laterally. The vocal cords at the moment of the emission of sound did not approach perfectly. The deaf-mute who is totally deaf has little or no control over his vocal cords.

RESPIRATORY MOVEMENTS. Examination showed that the children had a greater number of respiratory movements than the otherwise normal children of the same age. This was very easily determined, as the deaf-mutes were in the same building with the blind, and an abundance of material was at hand for comparison. It is clear that this class of unfortunates should be compelled to use gymnastic exercises for the throat and also chest exercises, which, so to speak, teach the thorax to dilate and to empty itself regularly—in other words, to functionate properly, and for this purpose lessons in spirometry are strongly advised by Jousset and others, for in this way the patients are taught to prolong the voice and to make it less monosyllabic.

Can the shape of the larynx tell us the nature of the voice? In answer to this question Jousset has found that the laryngoscope does not tell us the exact nature. The classification, according to the findings of the laryngoscope, does not answer or rather harmonize with the classification of the teacher, and this probably proceeds from the fact that in the normal voice the word and the laryngeal note are functions the one of the other, and that the deaf-mute is only educated for the word. Oral instruction only cultivates the gymnastics of this word;

¹ Rev. heb. de Laryngologie, etc., August 31, 1901, No. 35.

it does nothing for the larynx. It has been found in an examination of the voices of a large number of deaf-mutes that the alto voice is the most frequent. In twenty-one individuals there was only one soprano, all the other voices being altos. It has been found, too, that the pharynxes of the little patients were very wide, for among eighty-three children only twenty-three were found to have pharynxes of medium capacity. In a number of cases a catarrhal condition was found, showing itself in numerous granulations on the sides of the pharynx, which undoubtedly embarrassed the movements of the palate and interfered with the occlusion of the upper part of the pharynx. In a great many cases the tonsils were so much enlarged as to form a serious obstruction in the throat. The pharyngeal tonsil is frequently hypertrophied. The soft palate in a number of cases was very much relaxed, and, as a consequence, the nasal fossæ were incompletely closed. The shape of the anterior part was by no means classical, for in 24 per cent. of the cases the arch-shaped palate was observed. The uvula was often hypertrophied and elongated. The nasal respiration was always defective. Examination of the nasal fossæ of eighty-three deaf-mutes showed the inferior turbinates to be hypertrophied in more than half the cases and the middle turbinate quite large in others. The septum was thickened throughout its course, but this was more marked at its upper portion. Of course, this would have the effect of diminishing the capacity of the nasal fossæ and interfering with the circulation of the air in this region. In some cases, indeed, the nares on one side were completely closed by a spur.

When we take into consideration all these anatomical changes we can readily understand to some extent why the voice of the deaf-mute should have such a peculiar quality. When beginning this subject I dwelt upon the importance of a medical examination of this class of sufferers, and the investigations of Jousset have only served to strengthen me in this belief. In a number of cases, then, medical, surgical, and so-called gymnastic treatment should be instituted. Unfortunately the heads of institutions, the teachers, and even the patients themselves are little inclined to favor medical intervention. I think that every institution of this kind should have an able expert attached to its staff, and that every new-comer should be subjected to a rigid examination at the hands of this officer, to see whether, from his point of view, anything can be done, and especially should this rule be carried out in the case of children.

THE EYE GROUNDS IN INTRACRANIAL DISEASE OF OTITIC ORIGIN.

I have alluded to this subject in a previous report, but, so far as I know, Hansen's¹ recent communication is the most valuable and exhaustive work yet published. He has given us a thorough analysis of 100 cases of intracranial disease which had its origin in ear trouble. Taking 97 of these cases we see that 52 showed normal eye grounds, while in 45 cases the eye grounds were abnormal, and of these latter 19 cases showed slight changes in the optic disk. In 23 cases there was genuine optic neuritis, and in 3 cases there was choked disk. The changes seem to make their appearance least often in extradural abscess (otitic origin), and most often in those cases which are regarded as meningitis serosa.

The importance and frequency of optic nerve involvement in otitic disease of the brain imposes upon the otologist the duty of examining the eye grounds of every case of suppurating ear which he is called upon to treat. Even where there is no suspicion of cerebral trouble an ophthalmoscopic examination should be made, for a study of Hansen's results would indicate that in some cases the changes in the papilla may be the first and for a considerable time the only evidence of brain disease following the ear trouble. The importance, then, of the ophthalmoscope to the otologist as an aid to diagnosis is evident. Hansen advises that all these cases be subjected to an examination at the hands of an ophthalmologist, so that the two eye grounds may be compared. It is clear, however, that unless the otologist is also an ophthalmoscopist an early and, at the same time, constant inspection of the papilla in every case of this kind is out of the question.

¹ Archiv f. Ohrenheilkunde, Band liii. Festschrift Herrn Geh. Medicinalrath, Dr. Rudolf Virchow.

INDEX.

- ABDOMINAL** pain in typhoid, 170
 symptoms of cancer, 108
Aberrant types of typhoid fever, 152-156
Abscess, brain, and acid-proof ray fungus, 326
 cerebellar, 43
 cerebral, 41, 43
 hemorrhage from tonsillar, 396
 of brain and pneumonia, 183
 of liver after typhoid, 125
 of lung in typhoid, 159
 of tonsil, 69
 perinephritic, 160
 pulmonary and ray fungi, 326
 operation for, 143
 prognosis of, 142
 surgical treatment of, 140
 symptomatology of, 140
 retropharyngeal, and adenitis, 240
 subphrenic and ray fungi, 326
Abscesses, mediastinal, 73, 74
 peri oesophageal, 73
Acid-proof ray fungus and pneumonia, 326
 and brain abscess, 326
 tuberculoid bacilli, 320-323
Acids, production of, by bacteria, 303
Actinomycelial myelitis secondary to bronchiectasis, 327
 processes, 323
Actinomyces Israeli, 325
 transformation of, into aërobic type, 327
Actinomycosis, 323
 nomenclature of, 323
 of the foot, 326
Acute coryza, 387
Adenitis, retropharyngeal abscess and, 240
Adenoid growths, 251
Adenoids, changes in facial bones due to, 404
 conditions simulating, 404
 nasopharyngeal, 403
Adenomata of the adrenals, 356
Adrenal serum, 284
Adrenalin, 368
 anæsthetic action of, 369
 characteristics of, 368
 hæmostatic action of, 369
 in hæmophilia, 371
Adrenals, adenomata of, 356
 hæmochromatosis, with atrophy of, 338
Aërobic types, transformation of actinomyces Israeli, 327
Afebrile typhoid fever, 152
Affections, general, of the air-passages, 376
Agglutination, 300-302
 influence of salts in, 301
 Agglutination, mechanism of, 300
 of bacillus pestis, 312
 of blastomycetes, 328
 of red corpuscles by serum, 289
Agglutinin and proteid bodies, 302
Air currents in the nose, 366
 hot, in nasal affections, 375
 passages, foreign bodies in, 119
 methods of removal of, 121
 physiology of, 365
 surgery of, 119
 upper, general affections of, 376
 syphilis of, 379
Alexins of serums, 290
Alimentary tract, diseases of, 240
Amoebic dysentery, 196, 197
Amyloid changes, 337
 in syphilitic growths, 338
 tumors of thyroid, 359
Anæmia of typhoid fever, 156
 pernicious, in children, 267
Anæsthesia, local, 439
Anæsthetic action of adrenalin, 369
Anatomical conditions in mastoid operations, 432
Anatomy and histology, embryological basis of pathological, 329
 of Gasserian ganglion, 27
Aneurism, arterio-venous, of the subclavian vessels, 100
Aneurisms, 95-99
 of aorta, 95-99
 treatment of, by gelatin, 100-102
 by wire and electricity, 95-99
 effect of, 95, 96
 technique of, 97-99
Angina Ludovici, 56
Angiosarcoma of frontal lobe, 21
Animals, cold blooded, tuberculosis and, 316
Anomaly of ribs, 116
 of the tonsil, 67
Anticoagulative serum, 282
Antibacterial sera, 294
Antiblastomycetic serum in carcinoma, 352
Anti-hæmolysins, 286
Antihepatic serum, 284
Antisarcomatous serum, 353
Antrum disease, 395
Aorta, aneurisms of, 95-99
 treatment of, by gelatin, 100-102
 by wire and electricity, 95-99
 effect of, 95, 96
 technique of, 97-99
Appendicitis in children, 249
Arterial obliteration, 117

- Arteries, laceration of, in fractures, 100
wounds of, 91
treatment of, 91, 92
Arterio-sclerosis in the young, 259
Arterio-venous aneurism of the subclavian vessels, 100
Arthritis and pneumonia, 183
in typhoid fever, 165
Articular complications of scarlet fever, 218
Artificial modification of toxins, 304
Asthma, thymic, 289
Atrophic rhinitis, 402
electrolysis in, 402
Atrophy of adrenals, hæmochromatosis with, 338
Auditory apparatus, rheumatic affections of, 428
Aurium, tinnitus, 419
Axillary lymph gland in hydatid disease, 111
- BACILLI**, tuberculoid, acid-proof, 320-323
Bacilluria typhoid, 171, 172
Bacillus coli commune, toxin in, 305
mucous, 400
of Danyz, 177
pestis, 311
agglutination of, 312
vitality of, 175
pseudodiphtheria, 312
smegma, 320
tuberculosis, 313
bovine of human, 313
toxins and chemical composition of, 316
virulence of, 313
typhi murium, 177
typhoses in the blood, 157
in the rose spots, 157
in the urine, 171
Backward and deficient children, 229-232
classification of, 230
education of, 231
etiology of, 230
speech in, 230
Bacteria, branching of, 304
in the intestinal tract, 305
influence of salts on, 303
production of acid by, 303
structure of, 304
Bacterial diagnosis in empyema, 131
enzymes, 302
hæmolyseins, 286
immunity, 292-297
toxins, effects on nerves of, 341
Bactericidal action of normal serum, 298
in osmotic disturbances, 298
in starvation, 298
influence of pepsin, 305
of trypsin, 305
Bacteriological diphtheria, 186
Bacteriology, general, 302
of otitis media, 427
of pyæmia, 437
of rheumatism, 147
Bacteriology of summer diarrhœas, 244
of tuberculosis, 313
relation of, to clinical medicine, 306-308
Bacteriolysis and hæmolysis in relation to immunity, 291
in typhoid fever, 296
Bacterium diphtheroides, 313
Barley-water mixtures, 233
Basedow's disease. *See* Graves' disease.
Biliary acids, 290
Blastomycetes, agglutination of, 328
in carcinoma, 345
in the tonsils, 328
oidia and, 327
Blastomycetic dermatitis, 327
theory of cancer, 347
Blood and ductless glands, diseases of, 267
in infancy and childhood, 268
in scarlet fever, 217
in typhoid fever, 156, 157
laking of, 288
malarial, 289
serum, precipitins for, 279
test for human, 279-281
typhoid bacilli in, 157
Bloodvessels, heart and, 84
laceration of, in fractures, 100
surgery of, 84
Bone formation in lungs, 335
in other sites, 335
inflammatory changes in, 330
Bone marrow, multiple endothelioma of, 380
Bone, primary sarcoma of, 356
Bones, changes in facial, 404
Botulismus, 340
Bovine tuberculosis, 313
virulence of, 313
Brain abscess and acid-proof ray fungus, 326
and pneumonia, 183
injury, immediate effects of, 19
remote effects of, 19
malformations of, 17
skull and, 17
tumors of, 21
Branching bacteria, 304
Breaking of an instrument, 403
Breast, carcinoma of, 105
treatment by oöphorectomy, 106
by Röntgen rays, 105
by suction apparatus, 107
hydatid disease of, 109
pathology of, 110, 111
symptomatology of, 109, 111
male, carcinoma of, 107
surgery of, 102
tuberculosis of, 103
Breathing exercises, 405
Bronchiectasis, actinomycelial myelitis and, 327
operation for, 143
prognosis of, 140
surgical treatment of, 140
Bronchitis, 252
and influenza, 213
and ray fungus, 326

- Bronchopneumonia, 253
 and ray fungus, 324, 326
 Bryant's method for thoracotomy, 123
 Bubonic plague, 175, 309
 bacillus of, 175
 epidemic in Kobe and Osaka, 179
 histology of, 310
 infection by rats, 311
 prevention of, 177
 prophylactic inoculation, 179
 statistics on, 179, 180
- CALCIFICATION**, experimental, 336
 in kidney, 336
 in lungs, 336
 in stomach, 336
 Camphoroxol, 415
 Cancer. *See* Carcinoma.
 Cancrum oris. *See* Noma.
 Carcinoma, abdominal symptoms of, 108
 antiblastomycetic serum in, 352
 blastomycetic theory of, 345, 347
 cerebro-spinal symptoms in, 108
 changed red cells in, 346
 contagiousness of, 351
 Gaylord's protozoon of, 342
 in Buffalo, 349
 in Massachusetts, 350
 injuries the cause of, 349
 intracellular bodies in, 346
 laryngeal, 407
 lycopodium spores in, 346
 mammary surgery of, 103
 results of, 104, 105
 medical aspects of, 108
 miscellaneous articles on, 345
 of breast, 105
 treatment by oöphorectomy, 106
 by Röntgen rays, 105
 by suction apparatus, 107
 of male breast, 107
 of middle ear, 426
 of peritoneum, 288
 parasitic theories of, 346, 347
 primary, of lungs, 357
 protozoon theory of, 347
 relation of, to other tumors, 347
 sarcoma and, 348
 Schüller's parasites of, 343
 scirrhus, elastic fibres in, 354
 squamous, 357
 of gall-bladder, 357
 of renal pelvis, 357
 of ureters, 357
 statistics on, 349-351
 stimulation in, 346
 thoracic symptoms of, 108
 Virchow's theory of, 348
 Carcinomata, skin, treatment of, 52
 Carcinomatous and sarcomatous mixed
 growths, 348
 pleuritis, 288
 Cardiac dilatation, acute, 187, 217
 Catarrh, nasal, 389
 Catheterization of Eustachian tubes, 420
 Cerebellar abscess 43
 Cerebral abscess, 41, 43
 complications in removal of Gasserian
 ganglion, 31
 pressure in typhoid, 166
 sinuses, 41
 treatment of, 42, 43
 wounds of, 41
 Cerebro-spinal fluid, hæmolyasis by, 287
 meningitis, 214, 265
 bacteriology of, 266
 lumbar puncture in, 220, 266
 modes of infection in, 218
 purulent, 24
 unusual cases of, 219
 symptoms of cancer in, 108
 Cervical rib, 116-119
 symptoms of, 116-119
 sympathetic surgery, 83
 Chancres of the tonsil, 398
 Cheek, epithelioma of, 49, 361
 Chemical composition of *B. tuberculosis*, 316
 hæmolyasis, 290
 Chest, surgery of, 17
 wall, sarcoma of, 113
 operation for, 113-115
 Chicken-pox. *See* Varicella.
 Childhood and infancy, blood in, 268
 Children, appendicitis in, 249
 colic in, 243
 deficient and backward, 229-232
 classification of, 230
 education of, 331
 etiology of, 230
 speech in, 230
 diseases of, 221
 empyema in, 254
 general diseases of, 274
 heart murmurs in, 256
 nutrition and hygiene of, 228
 peritonitis in, 250
 pulse in, 228
 suicide in, 267
 temperature in, 228
 Widal reaction in, 157
 Cholangitis in typhoid fever, 160
 Cholecystitis in typhoid fever, 160
 Cholesteatoma, meningeal, 355
 of the pia, 355
 Chorea, 263
 knee-jerks in, 264
 lumbar puncture in, 264
 Cinnamic acid, treatment of tuberculosis by,
 315
 Circulatory system, diseases of, 256
 Cirrhosis of liver, 333
 Clasmatocytes, Ranvier's, 331
 Clinical medicine, relation of bacteriology
 to, 306-308
 Cocaine in the ear, 439
 toxic symptoms of, 439
 Cold-blooded animals, tuberculosis and, 316
 Colic in children, 243
 Colors, influence of, on mosquitoes, 208
 Complements, Ehrlich's views on, 294
 immune body and, 293
 regeneration of, 297
 source of, 294

- Complications of diphtheria, 187
 of influenza, 213-217
 of measles, 195
 of pneumonia, 182-184
 of typhoid fever, 158-168
 of varicella, 189
 Cones of drum membrane, 416
 Congenital acute nephritis, 260
 fissure of the palate, 424
 heart disease, 258
 typhoid fever, 158
 Constitutional diseases, opening mastoid in, 433
 Contagiousness of acute otitis media, 426
 of cancer, 351
 Convulsions in children, 265
 Coryza, acute, 387
 Cow's milk, modification of, 234, 235
 Crandall's method for modification of milk, 236
 Cranial nerves, 25
 Cretinism, 270
 Croupous pneumonia, 145, 181
 abscess of brain and, 183
 arthritis and, 183
 complications of, 182-184
 embolism in, 183
 endocarditis and, 183
 infective character of, 181
 inflammation of thyroid after, 184
 parotitis and, 182
 peritonitis and, 182
 purpura hemorrhagica after, 184
 sequelæ, 184
 serum reaction in, 182
 statistics on, 181
 treatment of, 184
 Cryoscopy, 287
 Cyanosis in the newborn, 221
 Cyclic vomiting, 251
 Cyst, echinococcus, 109
 hydatid, 110
 pathology of, 110
 Cystadenoma papilliferum of thyroid gland, 61
 Cytotoxin, pancreatic, 284
 Cytotoxins, 282
- D**EAF-MUTISM, 444
 respiratory movements in, 445
 voice in, 445, 446
 Deafness, diagnosis of, 441
 prognosis of, 441
 Decortication of lung for empyema, 124-131
 indications for, 126
 method of performing, 127
 results of, 128
 Deficient and backward children, 229-232
 classification of, 230
 education of, 231
 etiology of, 230
 speech in, 230
 Delirium in typhoid, 166
 Dermatitis, blastomycetic, 327
 Diabetes and mastoiditis, 433
 Diabetes in children, 274
 Diarrhoeas of infancy, 244
 bacteriology of, 244
 changes in liver and kidneys in, 245
 treatment of, 245-248
 Diathesis, uric-acid, 261
 Diet in scurvy, 273
 Dilatation of heart, 217
 Diphtheria, 185
 and measles, 195
 and middle-ear disease, 442
 bacteriological, 186
 cardiac dilatation in, 187
 complications of, 187
 pathology of, 187-189
 pharyngeal and typhoid fever, 163
 statistics on, 185
 ulcer of stomach in, 187
 Disappearing tumors, 352
 Disease, acquired heart, 256
 congenital heart, 258
 Diseases, antrum, 395
 general, of children, 274
 infectious, 145
 and milk, 239
 of alimentary tract, 240
 of blood and ductus glands, 267
 of children, 221
 of circulatory system, 256
 of faulty nutrition, 270
 of nervous system, 262
 of nutrition, 271
 of respiratory tract, 251
 of thymus gland, 268
 of urinary system, 259
 Disinfection and insect transmission, 145
 by formaldehyde gas, 146
 by sulphur dioxide, 146
 Distribution of goitre, 61
 Diverticula of œsophagus, 75
 Drainage in treatment of empyema, 132
 Drum membrane, cones of, 416
 Duct, thoracic, 83
 Ductless glands, diseases of blood and, 267
 Duodenum, occlusion of, 242
 ulcer of, 242
 Dysentery, 196
 amoebic, 196, 197
 infectious, 196, 197
 pathology of, 196-198
 serum reaction in, 196
 serum-therapy, 198
 Dysmenorrhœa, treatment of, 365
- E**AR, anæsthesia in, 439
 diseases, eye grounds in, 447
 external, 413
 hysteria and, 434, 444
 internal, 428
 mastoiditis without inflammation of, 431
 rheumatism of, 428
 middle, 414
 camphoroxol in, 415
 carcinoma of, 426
 diphtheria in, 442

- Ear, middle, fissures of palate and, 424
 menthoxol in, 415
 sclerosis of, 423
 suppurative processes in, 414, 416
 suprarenal extract in, 424
 polyp, 426
 rheumatic affections of, 428
 senile, 440
- Echinococcus cyst of breast, 109
 methods of infection, 112
- Education of feeble-minded children, 231
- Ehrlich's theory of hæmolysis, 291
 views on complements, 294
 on immune body, 295
- Elastic fibres in scirrhus cancer, 354
 tissue, 332
 and cirrhosis of liver, 333
 in chronic congestion of lungs, 333
- Electricity in cure of aneurisms, 95-99
- Electrolysis in atrophic rhinitis, 402
 in tympanic vertigo, 421, 422
- Embolism in pneumonia, 183
- Embryomata of ovary, 362
 of testicle, 362
- Empyema, bacterial diagnosis of, 131
 decortication of lung for, 124-131
 drainage in, 132
 in children, 214
 in typhoid, 159
 measles and, 195
 other methods of treating, 131
 surgical treatment of, 124-133
- Endocarditis and pneumonia, 183, 309
- Endocardium, foreign bodies in, 334
- Endolaryngeal removal of papilloma, 409
- Endothelioma of bone-marrow, 360
 of lung, 361
- Enlargement of thymus, 67
- Enteric fever. *See* Typhoid fever.
- Enuresis, 262
- Enzymes, bacterial, 302
 proteolytic, 305
- Epidemic of plague in Kobe and Osaka, 179
- Epidermis, healing in, 334
- Epididymitis in typhoid fever, 162
- Epilepsy, 37
 injection of eucaïne for, 39
 Jacksonian, 37
 operative treatment of, 37, 38
 removal of sympathetic ganglion for, 40
 traumatic, 40
- Epiphyseal separation in the newborn, 226
- Epistaxis, 47, 388
- Epithelioma of cheek, 49, 361
- Ethmoiditis, 392
- Etiology of carcinoma, 345
 of sarcoma, 345
- Eucaïne in epilepsy, 39
 in laryngectomy, 78, 79
- Eustachian tube, catheterization of, 420
- Exophthalmic goitre, 59
 pathology of, 59
- Experimental calcification, 336
 vaccinia, 191
- Exploration of œsophagus, 71
- External ear, 413
- Extirpation of larynx, 78
 eucaïne in, 78, 79
 mortality of, 80
 tracheotomy in, 78
- Eye grounds in ear diseases, 447
- FACE, surgery of, 47
 Facial bones, changes in, due to adenoids, 404
 nerve, 48
- Fatty changes, nature of, 336
- Feeble infants, 227
- Feeding, infant, 232
 barley-water mixtures in, 233
 Crandall's method of, 236
 Holt's method of, 233
 modification of cow's milk in, 234, 235
 Northrup's views on, 234
 pasteurization in, 238
 sterilization in, 238
- Findlay's results with yellow fever, 205
- Fish tuberculosis, 316
- Floating kidney, 260
- Foot, actinomycosis of, 326
- Foreign bodies in air-passages, 119-121
 in heart, 90, 334
 in lung, 124
 reaction of heart to, 334
 removal from œsophagus of, 72
- Formaldehyde gas, 146
- Formalin, 374
 use in rhino-laryngology, 374
- Fractures, lacerations of bloodvessels and, 100
 of base of skull, 21
 of skull, 19
 treatment of, 20
- Frontal lobe, sarcoma of, 22
 tumors of, 21
 sinus, 394
- GALL-BLADDER, squamous carcinoma of, 357
- Ganglioneuroma, 354
- Gangrene in the newborn, 226
 in typhoid fever, 163
 pulmonary, 140, 326
 operation for, 143
 prognosis of, 142
 ray fungi and, 326
 surgical treatment of, 140
- Gargles in throat troubles, 419
- Gasserian ganglion, 25
 anatomy of, 25
 cerebral complications of, 31
 histology of, 25
 method of removing, 29
 operative interference in, 28
 results in, 30
- Gastro-enteritis. *See* Diarrhoea.
- Gaylord's protozoon of cancer, 342
- Gelatin, treatment of aneurism by, 100, 102
- Genital areas in nose, 365

- Gland, parotid, tuberculosis of, 67
thyroid, 57 *See* Goitre.
amyloid tumor of, 359
cystadenoma papilliferum, 61
extract of, 63, 270
inflammation of, after pneumonia,
184
metastasis of, 358
mixed tumor of, 348
pathogenesis of enlargements of, 57
pathology of diseases of, 57, 58
sarcoma of, 60, 359
suppuration of, 158
sympathetic nerves and, 59
transplantation of, 270, 335
tumors of, 60
metastasis of, 358
vascular enlargement of, 359
- Glia tissue, 333
Globulolysis, 289
Goitre, 61
causes of death in, 66
distribution of, 61
indications for operation on, 63
operative measures in, 64
palliative remedies for, 63
sympathetic nerves and, 66
thyroidectomy for, 64
treatment of, 62
- Gout in the nose, 376
in the throat, 376
symptomatology of, 377
- Granulation tissue, human, 331
- Graves' disease, pathology of, 59
treatment of, 83
- Growths, adenoid, 251
laryngeal, 409
- Gummata of liver, 319
- Gummatous orchitis, 318
- HÆMACHROMATOSIS**, with atrophy of
adenoids, 338
Hæmoglobinæmia, 289
Hæmoglobinuria, 289
in typhoid fever, 163
Hæmolysins, anti-, 289
bacterial, 286
chemical, 290
Hæmolysis, 285
and bacteriolysis in relation to immun-
ity, 291
by cerebro-spinal fluid, 287
by urine, 287
Ehrlich's theory of, 201
in hemorrhagic pleuritis, 288
in sarcoma of pleura, 288
Hæmolytic serum, 285
urine, 288
Hæmophilia, 371
adrenalin in, 371
in the newborn, 223
Hæmoptysis other than pulmonary, 406
pseudo-, of nasopharyngeal origin, 407
Hæmostatic action of adrenalin, 369
Hay fever, 388
suprarenal extract in, 372
- Head injury, lumbar puncture in, 20
shaking, 263
surgery of, 17
traumatism in, 18
- Healing in epidermis, 334
- Hearing, influence of radical operation on,
423
inspecting, 438
treatment of, 438
- Heart, acute dilatation of, 217
disease, acquired, 256
congenital, 258
foreign bodies in, 90, 334
treatment of, 90
large vessels and, 84
murmurs in children, 256
surgery of, 84
wounds of, 84
treatment of, 86
- Hemiplegia complicating rheumatism, 149
- Hemorrhage from pyothorax, 255
from tonsillar abscess, 396
into suprarenal capsule, 225
intracranial, 224
treatment of, 225
meningeal, 18
- Hemorrhagic infection in the newborn, 224
pancreatitis, 162
pleuritis, 288
typhoid fever, 153
- Histogenesis of tuberculosis, 317
of tumors, 353
- Histological differentiation between tuber-
culosis and syphilis, 318
- Histology and anatomy, embryological, 329
general pathological, 329
of Gasserian ganglion, 25
of inflammatory processes, 330
of tuberculosis, 317
of tumors, 353
- History of laryngology and rhinology, 363
- Holt's method of infant feeding, 233
- Hot air in nasal affections, 375
- Human and bovine tuberculosis, 313
virulence of, 313
blood, test for, 279-281
granulation tissue, 331
- Hydatid disease of breast, 109
method of infection in, 112
pathology of, 110-111
symptomatology of, 109-111
- Hydrocephalus, 266
chronic, 17
- Hydrophobia, 340
- Hydropneumatic massage, 417
- Hygiene and nutrition in children, 228
school, 228
- Hypertrophic pyloric stenosis, 241
- Hysteria and the ear, 434, 444
- Hysterical mastoid pain, 434
- IMMUNE** body and complements, 293
Ehrlich's theory of, 295
source of, 294
- Immunity, bacterial, 292-297
hæmolysis, bacteriolysis, and, 291

- Immunity to malaria, 210
 Incubation period of yellow fever, 205
 Infancy and childhood, blood in, 268
 diarrhoea of, 244
 bacteriology of, 244
 changes in liver and kidneys, 245
 treatment of, 245-248
 Infant feeding, 232
 barley-water mixtures in, 233
 Crandall's method of, 236
 Holt's method of, 233
 modification of cow's milk in, 234, 235
 Northrup's views on, 234
 pasteurization in, 238
 sterilization in, 238
 food, production of milk for, 238-240
 newborn, 221
 Infantile scurvy, 273
 diet in, 273
 Infants, feeble and premature, 227
 sudden death in, 268
 Infarction of liver, 334
 Infection, accidental, with tuberculosis, 201, 202
 by rats, 311
 in yellow fever, 277
 mode of, in meningitis, 218
 through the navel, 225
 tonsils as portals of, 67
 Infectious diseases and milk, 239
 including acute rheumatism, croupous pneumonia, and influenza, 145
 dysentery, 196, 197
 Infective character of pneumonia, 181
 Inflammations of meninges, 22
 Inflammatory processes, 330
 histology of, 330
 in bone, 330
 in peritonitis, 330
 in pleuritis, 331
 in serous membranes, 330
 Influenza, 145, 213, 426
 acute dilatation of heart in, 217
 bronchitis in, 213
 complications of, 213-217
 meningitis and, 214
 palatal exanthem in, 213
 polyneuritis in, 214
 Innominate artery, 93
 ligation of, 93
 Milton's method, 93-95
 Inoculation of malaria by mosquitoes, 212
 phosphylactic for plague, 179
 Insect transmission and disinfection, 145
 Inspecting the hearing, 438
 Institute of medical research, 278
 Instrument breaking, 403
 Internal use, 428
 Intestinal lesions, absence of, in typhoid fever, 154
 sand, 248
 tract, bacteria in, 305
 tuberculosis in children, 203
 Intracellular bodies in cancer, 346
 Intracranial complications of middle ear disease, 43
 disease of otitic origin, 447
 eye grounds in, 447
 hemorrhage in the newborn, 224, 225
 Intrathoracic tracheotomy, 121
 Intubation trauma, 77
 symptomatology of, 77
 dangers of, 410
 laryngeal papilloma and, 410
 Intussusception, 248
 symptoms of, 248
 treatment of, 246
 Irreducible luxation in lower jaw, 53
 Irritation, a cause of cancer, 349

JACKSONIAN epilepsy, 37
 Jaundice in typhoid fever, 160
 Jaw, lower, irreducible luxation of, 53
 surgery of, 53
 Jaws, removal of upper and lower, 53
 operation for, 54-55
 Jugular vein, internal, venous stasis following ligation, 56
 ligation of, 436

KIDNEY, calcification in, 336
 floating, 260
 multiple leiomyoma of, 360
 Kidneys, changes in gastro-enteritis, 245
 Knee-jerks in chorea, 264
 Koch's paper on tuberculosis, 198-201

LACERATION of arteries in fractures, 100
 Laking of blood, 288
 Laryngeal bleeding, 406
 carcinoma, 407
 growths, 407
 dangers of intubation in, 410
 endolaryngeal removal of, 409
 thyrotomy for, 408
 tracheotomy for, 409
 stenosis in typhoid fever, 159
 tuberculosis, 374, 382, 386
 and pregnancy, 386
 Laryngectomy, 78
 eucaine in, 79
 mortality in, 80
 tracheotomy, 78
 Laryngology and rhinology, 363
 history of, 363
 therapeutics in, 368
 Larynx, 76
 exposure of pharynx and, 76
 extirpation of, 78
 eucaine in, 78, 79
 mortality in, 80
 tracheotomy in, 78
 rheumatism of, 379
 stenosis of, 78
 tuberculosis of, 374, 382, 386
 ulcer of, 77
 symptomatology of, 77

- Lateral ventricle, injury of, 41
 Leiomyoma, malignant, 360
 of kidney, 360
 Leontiasis ossea, 17
 Leucocytes in pneumonia, 308
 Ligation of innominate artery, 93
 Milton's, 93-95
 of jugular vein, 436
 Liver, abscess of, after typhoid fever, 175
 changes in gastro-enteritis, 245
 cirrhosis of, 333
 gummata of, 319
 necrosis of, 339
 regeneration of, in rupture, 334
 Local anæsthesia, 439
 Lumbar puncture, 220, 264, 265
 effects of, 24
 in head injuries, 20
 in meningitis, 22, 23
 Lung abscess in typhoid fever, 159
 decortication of, 131
 endothelioma of, 361
 foreign bodies in, 124
 surgery of, 134
 suture of, to chest wall, 115
 Lungs, bone formation in, 335
 calcification in, 336
 chronic congestion of, elastic tissue in, 333
 primary carcinoma of, 357
 Lycopodium spores in cancer, 346
- MALARIA**, 208
 immunity to, 210
 inoculation by mosquitoes in, 212
 mosquitoes and, 208, 212
 nephritis and, 213
 paludism without, 211
 preventive measures in, 209
 Malarial blood, 289
 nephritis, 213
 Male breast, carcinoma of, 107
 Malformation of skull, 17
 Malignant disease of tonsil, 68
 leiomyoma, 360
 Mammary carcinoma, 103-105
 tuberculosis, 103
 Massage, hydropneumatic, 417
 vibratory, 416
 Mastitis adolescentium, 102
 in typhoid fever, 102
 Mastoid, 429
 conservatism in opening, 434
 constitutional disease and, 433
 operations, 432
 pain, hysterical, 434
 symptoms of disease of, 429
 Mastoiditis, diabetes and, 433
 treatment without operation in, 432
 without inflammation of ear, 431
 Maxilla, inferior, 53
 Measles, 195
 complications of, 195
 diphtheria and, 195
 empyema and, 195
 noma and, 195
- Mechanism of agglutination, 300
 of globulolysis, 289
 Medical aspects of cancer, 108
 abdominal symptoms in, 108
 cerebro spinal symptoms in, 108
 thoracic symptoms in, 108
 research, institute for, 278
 Melæna in the newborn, 222
 Melanotic tumors, 361
 Meningeal cholesteatoma, 355
 hemorrhage, 18
 Meninges, inflammation of, 22
 Meningitis, 22
 cerebro-spinal, 24, 214
 bacteriology of, 266
 lumbar puncture in, 220, 265
 modes of infection in, 218
 unusual cases of, 219
 influenza and, 214
 lumbar puncture in, 22, 23
 purulent, 24
 serosa, 44, 45
 Meningo-encephalitis, 44, 45
 Menthol, 415
 Mediastinal abscesses, 73, 74
 Mediastinotomy, 73, 74
 Metastasis of normal thyroid, 358
 of thyroid tumors, 358
 Method of removing Gasserian ganglion, 29
 Micrococcus lanceolatus, 308
 Micro-organisms, influence of salts on, 303
 Middle ear, 414
 camphoroxol in, 415
 carcinoma of, 426
 disease, diphtheria and, 442
 intracranial complications of, 43
 in fissures of palate, 424
 menthol in, 415
 sclerosis of, 423
 suppuration in, 414, 416
 suprarenal extract in, 42-44
 Milk, infectious diseases and, 239
 modification of, 234-237
 pasteurization of, 238
 production of, for infant food, 238
 sterilization of, 238
 Milton's method, 93, 121, 123
 Mixed tumors, 348
 Modification of cow's milk, 234, 235
 Mosquitoes, influence of color on, 208
 inoculation of malaria by, 212
 yellow fever and, 203-205
 Mutism, deaf, 444
 respiratory movements in, 445
 voice in, 445
 in typhoid fever, 166
 Myelitis, actinomyoelial, 327
 Myocardium, foreign bodies in, 334
- NASAL** affections, hot air in, 375
 catarrh, 387
 polypus, 389
 cause of, 389
 diagnosis of, 390

- Nasal polypus, treatment of, 390
 Nasopharyngeal adenoids, 403
 Nature of fatty changes, 336
 Navel, infection through, 225
 Neck, surgery of, 17
 woody phlegmon of, 82
 Necrosis of liver, 339
 Necrotic and catarrhal bronchopneumonia, 324, 326
 Nephritis, 260
 congenital acute, 260
 malarial, 213
 Nephrotoxic serum, 282
 Nerve cells, phagocytosis of, 340
 facial, 48
 Nerves, bacterial toxins and, 341
 cranial, 25
 sympathetic and thyroid gland, 59
 Nervous system, diseases of, 262
 Neuralgia trifacial, 83
 Neuromata, ganglionic, 355
 Neurotoxic serum, 283
 Newborn, 221
 cyanosis in, 221
 epiphyseal separation in, 236
 gangrene in, 226
 hæmophilia in, 223
 hemorrhage in suprarenal capsule, 225
 hemorrhagic infection in, 224
 infection of, through navel, 225
 intracranial hemorrhage, 224
 melæna, 222
 ophthalmia, 222
 pathology of, 221
 respiratory failure in, 226
 Night-terrors, 262
 Noma, 50
 causes of, 50
 measles and, 95
 Nomenclature of typhoid fever, 150
 Nose, 47
 accessory sinuses, 394
 air currents in, 366
 genital areas in, 365
 gout in, 376
 symptomatology of, 377
 saddle, 47
 syphilis of, 379
 tuberculosis of, 381
 Nutrition, diseases of, 271
 faulty, diseases due to, 271
 in children, 228
- O**CCCLUSION of duodenum, 242
 (Esophagoscope, 72, 73)
 Oesophagus, 71
 diverticula of, 75
 exploration of, 71
 foreign bodies in, 72
 Oidia and blastomycetes, 327
 Oöphorectomy for cancer of breast, 106
 Operative interference in typhoid fever, 170
 Ophthalmia in the newborn, 222
 Orchitis, gummatous, 318
 in typhoid fever, 162
 tuberculous, 318
- Organic extracts in typhoid fever, 174
 Osmotic disturbances, 298
 Osseous styloid arch, 81
 Osteitis in typhoid fever, 165
 Osteomalacia, 361
 Osteomyelitis of sternum, 112
 Othæmatoma, 413
 Otitis media, acute, contagiousness of, 426
 mucosa, 425
 symptoms of, 425
 treatment of, 426
 suppurative, 427
 bacteriology of, 427
 Otogenous pyæmia, 435
 bacteriology of, 437
 operation for, 436
 Otology, 413
 Ovaries, transplantation of, 335
 Ovary, embryomata, 362
 Ozæna, 399-401, 402
- P**AIN, abdominal, 170
 hysterical mastoid, 434
 Palatal exanthem in influenza, 213
 Palate, congenital fissures of, 424
 palsy of, after typhoid fever, 175
 Paludism without malaria, 211
 Pancreatic cytotoxins, 284
 Pancreatitis, hemorrhagic, 162
 Papilloma, laryngeal, 407
 endolaryngeal removal of, 409
 intubation for, 410
 thyrotomy for, 407
 tracheotomy for, 409
 of urinary passages, 356
 Paracentesis of pericardium, 89
 Paraplegia dolorosa, 108
 Parasites, Schüller's, 343
 Parasitic theories of cancer, 346, 347
 Parathyroids, 57
 Parotid gland, 67
 tuberculosis of, 67
 Parotitis and pneumonia, 182
 Pasteurization of milk, 238
 Pathological anatomy, 329
 histology, 329
 Pathology, 277
 of diphtheria, 187-189
 of diseases of thyroid gland, 57
 of dysentery, 196
 of Graves' disease, 59
 of the newborn, 221
 Pepsin, bactericidal influence of, 305
 Perforation of tympanum, 441
 of typhoid fever, 170
 Pericarditis, suppurative, 88
 tubercular, 87
 Pericardium, foreign bodies in, 334
 paracentesis of, 89
 Perinephritic abscess, : 60
 Peri-oesophageal abscess, 73
 Peripheral nerves, action of toxins on, 341
 Peritoneum, carcinoma of, 288
 Peritonitis in children, 250
 inflammatory changes in, 330
 Pernicious anemia in children, 267

- Pest toxins, 313
 Phagocytosis of nerve cells, 340
 Pharyngeal diphtheria and typhoid fever, 163
 pouch, 70
 Pharynx, 70
 cicatricial stricture of, 70
 exposure of, 76
 Phlebitis, sinus, 45, 436
 Phlegmon, woody, of neck, 82
 Physiology of air-passages, 365
 Pia, cholesteatoma of, 355
 Pilocarpine in tinnitus aurium, 420
 Placentolysin and syncytiolysin, 284
 Plague bacillus, 175, 311
 agglutination of, 312
 bubonic, 175, 309
 bacillus of, 175, 311
 epidemic in Kobe and Osaka, 179
 histology of, 310
 infection by rats, 311
 prevention of, 177
 prophylactic inoculation, 179
 statistics on, 179, 180
 Plasma cells, 331
 Pleomorphic ray fungus, 324
 Pleura, sarcoma of, 288
 surgery of, 124
 Pleural effusions, 253
 Pleurectomy, 129
 Pleurisy, typhoid, 159
 Pleuritis, carcinomatous, 288
 hemorrhagic, 288
 inflammatory changes in, 331
 ray fungus and, 326
 tuberculous, 288
 Pleurotomy, 129
 Pneumonia, croupous, 145, 181
 abscess of brain and, 183, 326
 arthritis in, 183
 complications of, 182-184
 embolism in, 183
 endocarditis and, 183
 hemolytic action of urine in, 288
 infective character of, 181
 inflammation of thyroid gland after, 184
 leucocytes in, 308
 parotitis and, 182
 peritonitis in, 182
 purpura hemorrhagica, 184
 ray fungus and, 326
 sequelæ of, 184
 serum reaction in, 182
 statistics on, 181
 surgery of complications of, 140
 treatment of, 184
 broncho-, 253
 ray fungus and, 324
 Pneumococcus, 308
 endocarditis and, 309
 Pneumonic peritonitis, 132
 Pneumothorax, 139
 Poisoning by cocaine, 439
 Politzer bag, 420
 Polyneuritis, 216
 and influenza, 216
 Polyneuritis, typhoid, 167
 Polypi, rectal, 250
 Polyps of the ear, 426
 Polypus, nasal, 389
 cause of, 389
 diagnosis of, 390
 treatment of, 390
 Precipitins, 278
 for blood serum and other substances, 279
 for proteids, 281
 Pregnancy, laryngeal tuberculosis and, 386
 Premature infants, 227
 Preservation of teeth, 240
 Prevention of malaria, 209
 of plague, 177
 of yellow fever, 207
 Preventive measures in typhoid fever, 170
 Proliferating and regenerative processes, 331-335
 Prophylactic inoculation for plague, 179
 Protective bodies, agglutination and, 302
 Proteids, precipitins for, 281
 Proteolytic enzymes, 305
 Protozoon, Gaylord's, of cancer, 342
 theory of cancer, 347
 Pseudodiphtheria bacillus, 313
 hæmoptysis, 407
 Pulmonary abscess and ray fungi, 326
 complications of pneumonia, 140
 gangrene and ray fungi, 326
 operation for, 143
 prognosis of, 142
 surgical treatment of, 140
 hæmoptysis other than, 406
 tuberculosis, 134
 Pulse in children, 228
 Purpura hemorrhagica after pneumonia, 184
 Pyæmia, otogenous, 435
 bacteriology of, 437
 operation for, 436
 Pyelitis in typhoid fever, 167
 Pyelonephritis, 259
 Pyothorax, hemorrhage from, 255

RABIES, 340
 Ranvier's clasmotocytes, 331
 Rash, tonsillotomy, 398
 Rats, infection by, 311
 Ray fungus, 323
 acid-proof, 326
 and bronchitis, 326
 brain abscess and, 326
 bronchopneumonia and, 324
 in pleuritis, 326
 in pulmonary abscess, 326
 gangrene, 326
 in subphrenic abscess, 326
 pneumonia and, 326
 Rectal polypi, 250
 Recurrence of tonsils, 396
 Red cells, changes in cancer, 346
 Regenerative and proliferating processes, 331-335

- Regenerative and proliferating processes
in rupture of infarction of
liver, 334
of complements, 297
of sensory root of trigeminus,
32
- Remedies for goitre, 63
- Renal pelvis, squamous carcinoma of, 357
- Resection of sympathetic nerves, 66
- Respiratory failure in the newborn, 226
movements in deaf-mutism, 445
tract, diseases of, 251
- Retrogressive changes, 336-340
- Retropharyngeal abscess, 240
- Rheumatic affections of auditory apparatus,
428
- Rheumatism, 145, 147
bacteriology of, 147
hemiplegia complicating, 149
in children, 275, 276
in the larynx, 379
of the ear, 428
of the throat, 378
skin lesions in, 150
tonsillitis and, 378
- Rhinitis, atrophic, 402
electrolysis in, 402
- Rhinology and laryngology, 363
history of, 363
therapeutics in, 368
- Rib, cervical, 116-119
symptoms of, 116-119
- Ribs, anomaly of, 116
- Rickets, 270
- Rigors in typhoid fever, 153
- Ring knife, 392
- Röntgen rays. *See* X-rays.
- Rose spots, bacillus typhosus in, 157
- Rupture of liver, regeneration in, 334
- S**
- SADDLE nose, 47
- Salts, influence of, on agglutination, 301
on micro-organisms, 303
- Sand, intestinal, 248
- Sarcoma, etiology of, 345
miscellaneous articles on, 345
of bone, 356
of chest wall, 113-115
of frontal lobe, 22
of pleura, 288
of sternum, 113
of thyroid gland, 61, 359
vascular involvement in, 359
- Schüller's parasites of, 343
serum of, 353
stroma of, 354
transplantation of, 351
- Sarcomatous and carcinomatous growths,
348
- Scarlet fever, 217
articular complications of, 218
condition of blood in, 217
statistics on, 217
- Schede's operation, 130
- School hygiene, 228
- Schüller's parasites, 343
- Scurvy, 273
diet in, 273
infantile, 273
- Scirrhus of middle ear, 423
- Scirrhus carcinoma, elastic fibres in, 354
- Senile ear, 440
- Sensory root of trigeminus, 31, 33
division of, for tic douloureux, 31
method of removal, 33-35
results of, 37
regeneration of, 32
- Sequels of pneumonia, 184
of typhoid fever, 175
- Sera, antibacterial, 294
- Serous membranes, inflammatory changes
in, 330
- Serum, adrenal, 284
agglutination of red corpuscles by,
289
antiblastomycetic, 352
anticoagulative, 282
antihepatic, 284
antisarcomatous, 353
bactericidal action of, 298
haemolytic, 285
nephrotoxic, 282
neurotoxic, 283
reaction in dysentery, 196
in pneumonia, 182
in tuberculosis, 319
therapy in dysentery, 198
treatment of tumors, 352
- Serums, alexins of, 290
- Sinus, frontal, 394
phlebitis, 45, 436
sphenoidal, 395
thrombosis, 45
- Sinuses, accessory, of nose, 394
cerebral, 41
treatment of, 42, 43
wounds of, 41
- "Sirop de Gibert," 380
- Skin cancers, 52
lesions in rheumatism, 150
vaccinal, 194
- Skull and brain, 17
malformations of, 17
fractures of, 19, 20
of base of, 21
variations of, 27
- Smallpox and vaccination, 190
etiology of, 190
- Smegma bacillus, 320
- Specific cause of vaccinia, 192
- Speech in backward children, 230
- Sphenoidal sinus, 395
- Spinal anaesthesia in children, 266
- Spokeshave, 392
- Spondylitis typhosa, 164
- Squamous carcinoma, 357
- Starvation, bactericidal action in, 298
- Statistics in regard to tumors, 349-351
on diphtheria, 185
on plague, 179, 180
on pneumonia, 181
on scarlet fever, 217
on typhoid fever, 152

- Stenosis, hypertrophic pyloric, 241
 of larynx, 78
 Sterilization of milk, 238
 Sternum, osteomyelitis of, 112
 sarcoma of, 113
 Stomach, calcification of, 336
 ulcer of, 187, 242
 Stricture of pharynx, 70
 Structure of bacteria, 304
 Styloid arch, 81
 Subclavian vessels, arterio-venous aneurism
 of, 100
 Submucous cauterization, 394
 Subphrenic abscess, 326
 Suction apparatus in cancer of breast, 107
 Sudden death in infants, 268
 Suicide in children, 267
 Sulphur dioxide, 146
 Suppuration in middle ear, 416
 in varicella, 189
 of thyroid gland, 158
 Suppurative otitis media, 414, 427
 bacteriology, 427
 pancreatitis, 80
 processes of middle ear, 414
 Suprarenal capsule, hemorrhage into, 225
 extract, 47, 368
 anæsthetic action of, 369
 characteristics of, 368
 hemostatic action of, 369
 in ear disease, 424
 in hæmophilia, 369
 in hay fever, 372
 untoward effects of, 373
 gland. *See* Adrenals.
 Surgery of air-passages, 119
 of bloodvessels, 84
 of breast, 102
 of cervical sympathetic, 83
 of chest, 17
 of face, 47
 of head, 17
 of heart, 84
 of jaw, 53
 of lung, 134
 of mammary carcinoma, 103
 of neck, 17
 of pleura, 124
 of pulmonary complications, 140
 of thoracic wall, 112
 Surgical treatment of bronchiectasis, 140
 of empyema, 124-133
 of pulmonary abscess, 140
 gangrene, 140
 of tuberculosis, 134
 cases suitable for, 134
 method of operating, 135-137
 results of, 137
 Sympathectomy, 83
 Sympathetic, cervical, surgery of, 83
 ganglion, removal of, for epilepsy, 40
 nerves and thyroid gland, 59
 resection of, 66
 Syncytiolysin, 284
 Syphilis and tuberculosis, 318
 differentiation between, 318
 of upper air-passages, 379
 Syphilitic growths, amyloid changes in, 338
 origin of othematoma, 413
 Syringomyelia, 17
 TEETH, preservation of, 240
 Temperature in children, 228
 Teratoma of testicle, 362
 Test for human blood, 279-281
 Testicle, embryomata of, 362
 teratoma of, 362
 Tetany, 264
 Therapeutics in laryngology, 368
 in rhinology, 368
 Thoracic duct, 83
 symptoms of cancer, 108
 wall, surgery of, 112
 Thoracotomy, 131
 anterior, 122
 Bryant's method, 123
 posterior, 122
 Throat, gargles in, 419
 gout in, 376
 symptomatology of, 377
 rheumatism and, 378
 syphilis of, 379
 Thrombosis, sinus, 45
 Thymic asthma, 269
 Thymus gland, diseases of, 268
 enlargement of, 67
 Thyroid gland, 57. *See* Goitre.
 amyloid tumor of, 359
 cystadenoma papilliferum, 61
 extract of, 63, 270
 inflammation of, after pneumonia,
 184
 metastasis of, 358
 mixed tumor of, 348
 pathogenesis of enlargements of,
 57
 pathology of diseases of, 57, 58
 sarcoma of, 60, 359
 suppuration of, 158
 sympathetic nerves and, 59
 transplantation of, 270, 335
 tumors of, 60
 metastasis of, 358
 vascular enlargement of, 359
 Thyroidectomy, 64
 causes of death in, 66
 for Graves' disease, 64
 mortality in, 65
 technique of, 64
 Thyrotomy for laryngeal growths, 408
 Tic douloureux, 25
 medical treatment of, 28
 surgical treatment of, 28-31
 Tinnitus aurium, 419
 pilocarpine in, 420
 Tissue, elastic, 332
 glia, 333
 human granulation, 331
 Tonsil, abscess of, 67, 69, 328, 396
 anomaly of, 67
 chancre of, 398
 malignant disease of, 68
 Tonsillar abscess, hemorrhage from, 396

- Tonsillitis and rheumatism, 378
 Tonsillotomy rash, 398
 Tonsils as portals of infection, 67
 blastomycetes in, 328
 excision of, 396
 recurrence after, 396
 Torticollis, treatment of, 83
 Toxins, artificial modification of, 304
 bacterial, 341
 of bacillus tuberculosis, 316
 of colon bacillus, 305
 pest, 313
 Tracheotomy for laryngeal growths, 409
 in extirpation of larynx, 78
 intrathoracic, 121
 Transmission of tuberculosis, 199
 of yellow fever, 203-205
 by mosquitoes, 203-205
 by subcutaneous injection, 204
 Transplantation of ovaries, 335
 of sarcoma, 351
 of thyroid gland, 270, 335
 Traumatic epilepsy, 40
 Traumatism of head, 18
 Treatment of acute mastoiditis, 432
 of adenoid growths, 251
 of aneurism, 95-102
 of antrum disease, 395
 of arterio-venous aneurism, 100
 of atrophic rhinitis, 402
 of bronchitis, 252
 of bronchopneumonia, 253
 of cancerum oris, 51
 of carcinoma of breast, 105-107
 of cerebro-spinal meningitis, 22, 24, 45, 265
 of colic, 243
 of coryza, 387
 of cretinism, 270
 of diarrhoeas of infancy, 245-248
 of dysmenorrhœa, 365
 of empyema, 124-133, 254
 of epilepsy, 37, 38
 of epistaxis, 47, 388
 of foreign bodies in air-passages, 119-121
 in heart, 90
 of goitre, 62
 exophthalmic, 83
 of Graves' disease, 83
 of hay fever, 372, 388
 of hearing, 438
 of heart disease in children, 257
 of hydrocephalus, 266
 of intracranial hemorrhage, 225
 of intussusception, 249
 of laryngeal cancer, 407
 papilloma, 408
 tuberculosis, 374, 383-386
 of mastitis adolescentium, 102
 of meningitis serosa, 45
 of meningo-encephalitis, 45
 of nasal catarrh, 387
 polypus, 390
 of noma, 51
 of otitis media mucosa, 414, 426
 of pleural effusions, 254
 Treatment of pneumonia, 184
 of pneumothorax, 139
 of retropharyngeal abscess, 241
 of rheumatism in children, 226
 of rickets, 271, 272
 of saddle nose, 47
 of scurvy, 273
 cf skin cancers, 52
 of suppurative processes of ear, 414
 of tic douloureux, 28
 of tinnitus aurium, 419
 of torticollis, 78
 of trifacial neuralgia, 83
 of tuberculosis, 134, 315
 of larynx, 374, 383-386
 of tympanic vertigo, 421
 of typhoid bacilluria, 171, 172
 by organic extracts, 174
 of wounds of arteries, 91, 92
 of cerebral sinuses, 42, 43
 of heart, 86
 serum, of tumors, 352
 surgical, of bronchiectasis, 140
 of empyema, 124-133
 of pulmonary abscess, 140
 gangrene, 140
 of tuberculosis, 134
 cases suitable for, 134
 method of operating for, 135
 results of, 137
 Trigeminus, 25
 treatment of, 31
 Trocar, turbinal, 393
 Trypsin, bactericidal influence of, 305
 Tubercular pericarditis, 87
 Tuberculoid bacilli, 320-323
 Tuberculosis, accidental infection with, 201
 and syphilis, 318
 bacteriology of, 313
 bovine, 313
 cavities in, 134
 surgery of, 134-137
 cold-blooded animals and, 316
 histogenesis of, 317
 histology of, 317
 human, 313
 intestinal in children, 203
 Koch's paper on, 198-201
 mammary, 103
 of larynx, 374, 382-386
 of parotid gland, 67
 of upper air-passages, 381
 serum reaction in, 319
 transmission of, 199
 treatment of, by cinnamic acid, 315
 Tuberculous orchitis, 318
 pleuritis, 288
 Tumor, amyloid, of thyroid, 359
 Tumors, 342
 brain, 21
 disappearing, 352
 histogenesis of, 353
 histology of, 353
 interesting forms of, 354
 laryngeal, 437
 melanotic, 361
 mixed, 348

- Tumors of thyroid gland, 60
 relation of, to each other, 347
 serum treatment of, 352
 statistics on, 349-351
 thyroid, metastasis of, 358
 Virchow's theory of, 348
 Turbinal trocar, 393
 Turbinales, 392
 Turbinotomy, 392
 Tympanic vertigo, 421
 electrolysis in, 421, 422
 Tympanum, perforation of, 441
 Typhoid fever, 150
 abdominal pain in, 170
 aberrant types of, 152-156
 abscess of liver after, 175
 of lung in, 159
 absence of intestinal lesion in, 154
 of Widal reaction in, 154
 afebrile, 152
 anæmia of, 156
 arthritis and, 165
 bacilli in the blood in, 157
 in the rose spots in, 157
 in the urine in, 171
 bacilluria, 171
 bacteriology of, 307
 bacteriolysis in, 296
 blood in, 156, 157
 cerebral pressure in, 166
 cholangitis in, 160
 cholecystitis in, 160
 complications of, 158-168
 congenital, 158
 delirium in, 166
 empyema in, 159
 epididymitis in, 162
 gangrene of skin in, 163
 hæmoglobinuria in, 163
 hemorrhagic, 153
 pancreatitis in, 162
 jaundice in, 160
 laryngeal stenosis in, 159
 mastitis in, 102
 mutism in, 166
 neuritis in, 167
 nomenclature of, 150
 orchitis in, 162
 osteitis, 165
 palay or palate after, 175
 perforation in, 168-170
 pharyngeal diphtheria and, 163
 pleurisy, 159
 preventive measures in, 170
 pyelitis in, 167
 rigors in, 153
 sequels of, 175
 spondylitis typhosa and, 164
 statistics on, 152
 suppuration of thyroid gland in, 158
 treatment of, by organic extracts, 174
 urine in, 171
 "vaccination" for, 172-174
 Widal reaction in, 157
- ULCER of duodenum, 242
 of stomach, 187, 242
 Upper air-passages, general affections of, 376
 syphilis of, 379
 tuberculosis of, 381
 Ureters, squamous carcinoma of, 357
 Uric-acid diathesis, 261
 Uricæmia, 261
 Urinary passages, papilloma of, 356
 system, diseases of, 259
 Urine, freezing of, 288
 hæmolysis by, 287
 hæmolytic action of, 288
 injection of, 289
 typhoid bacilli in, 171
 Urotropin in typhoid bacilluria, 171, 172
- VACCINIA, experimental, 191
 specific cause of, 192
 Vaccinal skin lesions, 194
 Vaccination for typhoid fever, 172-174
 smallpox and, 190
 Varicella, 189
 complications of, 189
 maligna, 190
 suppuration in, 189
 Variola. *See* Smallpox.
 Vascular enlargement of thyroid, 359
 Venous stasis following ligation of jugular vein, 56
 Ventricle, lateral, injury of, 41
 Vermiform appendix, 306
 Vertigo, tympanic, 421
 electrolysis in, 421, 422
 Vibratory massage, 416
 Virchow's theory of tumors, 348
 Vitality of bacillus pestis, 175
 Voice in deaf-mutism, 445
 Vomiting, cyclic, 251
- WIDAL reaction, absence of, 154
 in children, 157
 Woody phlegmon of neck, 82
 Wounds of cerebral sinuses, 42
 of heart, 84-86
 of large vessels, 91-92
 of thoracic duct, 83
- X-RAY, 119
 in inoperable cancer of breast, 105
 treatment of skin cancers, 52
- YELLOW fever, Findlay's results with, 205
 incubation period of, 205
 infection in, 277
 prevention of, 207
 transmission by mosquitoes, 203-205
 by subcutaneous injection, 204

